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AVIATION

The Oldest American Aeronautical Magazine

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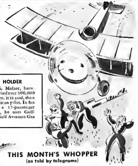
The Birdmen's Perch



Sometimes your editor wishes that all pilots were old maids Then he'd always be sure of having bales of gossip for this page So, please, after you run through this page, swipe a post-office pen and shoot us some news. Direct your letters to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh Pa

ONE TOOTH? PHOOEY!

"W N s ' story about *one* false tooth being air-expressed from Nassau to Miami is small potatoes I know of a South Carolina gentleman who had his 9-year-old *upper and lower plates* flown from Spartanburg to Greenville for repairs.' —J B

WHAT'S A MOTOR MORE OR LESS?

"A lady flier tells me this one about a test pilot

"While he was up putting a plane through its paces, the motor fell out. But the pilot just lifted his eyebrows, kept his hands on the stick, and landed the plane in front of the hangar

"As the ground crew stood there open-mouthed, he shrugged his shoulders, climbed in his car and motored away, not saying one blame word

"She said she d forgotten the pilot's name, but heard he was working at some airport in Connecticut Can anyone set me right on this?" —P W

RECORD HOLDER

Major Leslie G, Mulzer, barnstormer, has carried over 300,000 passengers, more, it is said, than any other American pilot. In his newest plane, a 17-passenger Ford tri-motor, he uses Gulfpride Oil and Gulf Aviation Gas exclusively

THIS MONTH'S WHOPPER
(as told by telegrams)

SID WARD, NEWARK, N.J MY PLANE JENNY DISAPPEARED LAST NIGHT. REPORTED OVER HARRISBURG HEADED EAST PLEASE KEEP EYE PEELED. ART EATON, CHICAGO, ILL.

ART. YE GODS! DIDN'T THINK THAT OLD CRATE COULD GET OFF THE GROUND. SID.

SID. POLICE PLANE AT MORRISTOWN, N.J., REPORTS JENNY FLYING UPSIDE DOWN WITHOUT A PILOT. CLAIM THEY DISTINCTLY HEARD HER YELLING "WHOOPEE." NO ONE CAN CATCH HER. WILL YOU HELP? ART.

ART. WILL HAVE YOU IN JAIL FOR THIS YOUR JENNY NOW OVER THIS AIRPORT LOOPING LIKE MAD AND WON'T STOP. CLAIMS SHE'S AN EAGLE WHAT DID YOU DO TO HER? SID.

SID DIDN'T DO ANYTHING EXCEPT GIVE HER A FILLING OF GULF AVIATION GAS ART.

ART. THAT'S ENOUGH TRAILED JENNY TO PHILADELPHIA SHE CHASED COWS AND DID BARREL ROLLS ALL THE WAY SAYS SHE WON'T COME BACK TO YOU UNLESS YOU PROMISE TO FEED HER GULF AVIATION GAS ALWAYS MAKES HER FEEL LIKE A SPRING CHICKEN SID.

SID. TELL JENNY I PROMISE ART.

ART. O.K. BUT I WANT IT IN WRITING. JENNY.

NEW CURTISS PLANE EQUIPPED WITH GOODRICH AIRPLANE PRODUCTS

Goodrich Rubber Products Again Prove Safety and Dependability by Passing Rigid Military Requirements for New Curtiss Attack Planes

Curtiss production lines have swung into action on another big order for "service" planes. The new YIA 18 Attack Planes will give the U. S. Army the last word in aggressive high speed units.

Throughout the construction of these Army Fighters, Goodrich aviation products have important jobs. More than a dozen Goodrich products contribute to the safety and smooth operation of these ships—products that have been chosen again and again by Curtiss for their time-tested ability to give long, "trouble free" service. More proof that the builder of the famous Goodrich Airplane Silvertown Tire is also the most able builder of the many other rubber products aviation needs today — whether simple gaskets or elaborate De-Icer equipment.

Why not give *your* planes the extra safety—the extra dependability of Goodrich-made airplane products? Remember, there are over 40 Goodrich rubber products for airplanes. See your nearest Goodrich Dealer or write Department 622, Aeronautical Division, The B. F. Goodrich Company, Akron, Ohio, for complete information.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

At left. THE CURTISS SOC 1 Scout Observation Plane. Curtiss has already built 135 of these rugged ships as "eyes" for the U. S. Navy and 48 more are on the way. In addition to having Goodrich Airplane Silvertowns for extra landing safety, these Curtiss planes are built with many other Goodrich airplane products. Hidden from sight, these Goodrich accessories are chosen because they measure up to the high standard of dependability demanded by Curtiss.

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Tomorrow's Clippers

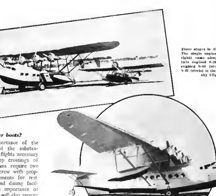
The designer of ships that have pioneered ocean routes discusses some of the problems of transoceanic flying equipment

By I. I. Sikorsky

Sikorsky Aircraft
Division of United Aircraft Corporation

ONLY a few years ago the establishment of scheduled air transportation for passengers and mail across the vast ocean barriers which have hindered swift international trade for centuries was considered a wild dream Yet the dream became reality on April 17, 1935, when the Pan American Airways Clipper crossed the Pacific on a scheduled flight to Honolulu, and later by well controlled steps (after infinitely careful preliminary preparation) pushed her way across to Midway, to Wake, to Guam and to Manila It is no longer questioned that rapid and comfortable transportation by air across the oceans will be routine within a few years Although the development of aircraft making possible this great advance has been much more rapid than the development of any other form of transportation, what knowledge we do have has been gained only by a vast amount of meticulous study and effort on the part of the manufacturers of equipment and operators

The writer believes that while various types of aircraft heavier as well as lighter than air, could be and on several occasions were successfully used, it is the large flying boat which offers most advantages for the safety, efficiency and success of a regular transoceanic airline. This, however, must not be considered a final prediction for the future. Eventually, other types of aircraft may be developed that will offer enough advantages to warrant careful consideration of their possibilities For example, aircraft with power units, fuel, useful load, living quarters, etc situated inside the wing boundaries may be developed and may prove satisfactory for transoceanic service. Other types may be developed that will take off from the ground or even from a rail track [cf "Land Launched Seaplanes," Frank T Courtney, AVIATION, September, 1936—Ed] and will have provisions for landing on the water either in cases of emergency or regularly. For the immediate future, however, the large flying boat appears to offer the best solution. Several considerations point to a flying boat of reasonably large size—say 80 to 100 000 lb minimum



Three stages in Sikorsky design. The single engined S-39 (above right) came along between the twin engined S-38 and the four engined S-40 (above left). The S-42 (circle) is the present Sikorsky Clipper

Why larger boats?

The importance of the service and the substantially long flights necessary on non stop crossings of major oceans require two shifts of crew with proper arrangements for rest sleeping and dining facilities The importance of the service will also require large and expensive equipment for radio, navigation etc. This equipment and large crew is a costly overhead which can be justified only by carrying a number of passengers well in excess of the number of crew The passengers must also have good accommodations, sleeping quarters, dining service and plenty of room to move about

Finally, the importance of reliable flight for thousands of miles without forced landings makes it vital that the major mechanisms of the plane (motors, fuel and oil tanks and lines, controls, etc.) should be accessible for inspection and maintenance in flight To enable the crew to carry out such work properly it would be necessary to carry on board a small repair shop and stock room with the essential spare parts and materials It would be necessary to provide accessibility to all major parts of the boat hull and wings for whatever service or repair might become necessary These, and many other considerations, point to an aircraft of substantially large size for transoceanic travel

Not the least among other requirements, the plane must have at least four (and possibly six or more) engines to permit good flying characteristics should part of the engines be out of commission. It must have good blind flying characteristics and be well adapted to fly in stormy weather The latter suggests the need for heavy wing loading It is probable that wing loadings between 30 and 40 lb per square foot will be commonly used on such ships. [See also *Journal of the Aeronautical Sciences*, July 1936, p 319—Ed.]

But undoubtedly the most difficult problem is in obtaining the requisite long flying range This can not be secured by any means other than through all-round high efficiency of the aircraft The plane must possess excellent performance and flying characteristics in spite of the combination of heavy wing loading with heavy power loading Therefore, a very clean design, high aspect ratio and high L/D are essential

The 4500 mile range which is adequate to permit non-stop operation across the North Atlantic (which also appears sufficient for any other major air route in the world) may not appear at first to be particularly difficult to obtain Several standing world records are above this mark The present seaplane record, however, is still considerably below this figure, and what is more important record flights are usually made with the ship overloaded above the A T C stress requirements, fitted with no soundproofing, and carrying little or no payload For the case under discussion, the plane would have to produce this range within the

load factors, take off, stability and other characteristics required by the regulations The ship further would have to carry a payload of 7–10 per cent of the gross weight. A lifting capacity about equal to the payload would have to be assigned to the various items of comfort such as carpets, soundproofing, sleeping and dining accommodations, galley, food, water, heating plant, electrical equipment, etc. Thus on a plane of 100,000 lb gross, these items would represent a load of 8 to 10,000 lb. according to the degree of luxury required From the standpoint of design engineering, all this is useful load to be carried in spite of the fact that in a contract it is usually called structural weight To combine the carrying of all interior furnishings, plus 30 or 40 passengers, luggage, a large crew and extensive equipment, with a 4500 mile cruising range is a very difficult problem, and at the present time there is no airplane in existence that can accomplish this feat.

Only a few years ago such aircraft could not have been produced on the basis of knowledge and materials then available However, the progress that has been made in aviation in general and in the several items mentioned below has made it possible to build a transoceanic airliner to fulfill the above mentioned requirements Outstanding have been (a) the development of the constant speed propeller, (b) the remarkable improvement in engines, particularly in high take-off rating combined with low fuel consumption at cruising power; (c) various aerodynamic developments, particularly special types of flaps to meet take-off and landing conditions with the use of high wing loading

It is worth mentioning that when a new design is under consideration and diligent effort is being made by an engineering group to raise performances to a possible maximum, it often appears that there is no course open for further improvement beyond the design which is being prepared When the plane is finally completed and thoroughly tested and studied, however, essential direct information and valuable experimental data, together with general research and other information, becomes available This in turn opens new avenues of possible improvement and gradually a more advanced design is evolved which often exceeds by far the previous one An example of such progress can clearly be seen in the accompanying tables which give comparative performances of the S-40 and S-42 flying boats, both designed by the same engineering group

The S-40 was placed in service in 1931 The first plane, called the "American Clipper," is the ancestor of the flying Clipper ships of the Pan American fleet In 1931 this ship was considered one of the leading seaplanes in the world In 1934 the S-42 Clipper type was placed in service. This ship was used to make a considerable reduction in the time of the South American schedule, and in 1935 it made possible the beginning of regular trans-Pacific flying

The following tables give comparative data on the S-40 and the latest type of S-42, the S-42-B, based on a range of 1000 miles

Table I

	S 40	*S 42 B*
Gross Weight	34,000 lb	42,000 lb
Equipment	3,000 lb	4,550 lb
Crew	1,000 lb	1,000 lb
Pay Load	3,200 lb	9,850 lb
Cruising Speed (1900 ft.) m p h	115	154
High speed m p h	137	180
Horsepower	2,300	3,000
Landing speed, m p h	65	65
Range, miles	1,000	1,000
Wing Loading	19.5	31.8

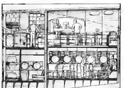
Table II gives the comparative efficiency of both ships based on ton miles of payload per gallon of fuel on the basis of a thousand mile range.

	S 40	*S 42 B*
Miles per gallon	.82	1.0
Payload in tons (1000 miles)	1.6	4.925
Ton mile per gallon	1.31	4.925

Table III gives the comparative range of both planes based on the same crew, same flying equipment and 1000 lb. of mail carried

	S-40	*S 42 B*
Gross Weight	34,000 lb	42,000 lb
Weight Empty	21,000 lb	*21,050 lb
Equipment	1,000 lb	1,000 lb
Crew	1,000 lb	1,000 lb
Gas	9,400 lb	18,700 lb
Oil	600 lb	1,250 lb
Payload	1,000 lb	1,000 lb
Range, miles	*1,310*	*3,466*
Miles per gallon	.835	1.245

* Weight Empty with extra gas tanks



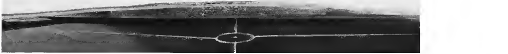
A section of the S-46, now in engineering, indicative of the size and general accommodations of tomorrow's clippers

It is not the object of this article to discuss the various items on which the general efficiency of a design depends It may, however, be of interest to mention briefly the few particular factors that influence the relation between size and efficiency, because certain disagreement exists on this subject In the past it has often been considered that the structural weight of a plane of substantially larger size would become prohibitively great compared to the lifting capacity of the wings, and therefore, the larger the plane the smaller would be the ratio of useful load to gross weight

Space does not permit going deeply into this problem, but an extensive study of this subject brought the writer to the following conclusions:

(1) While it is correct that the structural weight of the wing increases faster than the lifting capacity when the plane becomes larger, the structural weight of most other items may remain substantially in proportion to the gross weight and the proportional parasite resistance improves in the larger ship This is particularly noticeable with respect to boat hulls and side floats, as can be seen in Table IV on page 49

(Turn to page 49)



1936 Race Planes, Race People

The author, formerly AVIATION'S West Coast Editor, now associated with Al Menasco and his engine company, has had unusual opportunity to size up design trends at this year's National Air Races.

By Charles F. McReynolds

Photos by McReynolds

Above—Bendix winning Beechcraft piloted by Louise Thaden Below—Thompson winning Caudron flown by Detroyat

TWO outstanding design features marked the 1936 National Air Races and, if they may be taken as indicating a trend, both were of significance. Most striking was the almost complete sweep of the racing field by aircraft powered with engines of in-line type, but one place being taken by a radial powered plane in the course of all free-for-all closed course racing Also noteworthy was the complete dominance, for the first time in the history of American racing, of the "clean" airplane, the cantilever monoplane with retractable landing gear, and with no exposed struts, wires, or other drag producing features To observers accustomed to a long line of wire and strut braced racers with fixed landing gears, such as the Laird Solution, the Gee Bees, Wedell-Williams, Howard's "Mike" and "Mister Mulligan," "Miss Los Angeles," Miles & Atwood Special, and other famous and successful racers which have been wont to scream their way to victory to the tune of the howling brace wires, it was a cause for pop-eyed perturbation to witness cantilever monoplanes with fully retractable landing gear win all first places in the meet the first two places in both 550-cu in. events, and the first four places in the Thompson Trophy It would seem that nothing short of a design miracle can ever dethrone the cantilever monoplane racer

Nevertheless, the cautious designer will not be stampeded into a complete abandonment of his beloved wire braced thin wings, etc., without at least giving a few thoughts to the fact that the wire braced "Miss Los Angeles" has placed in the money three times in three starts in Thompson Trophy competition, and that the strut braced Chester Special, with fixed cantilever landing gear, this year was beaten only by the new Folkerts Special flown by Neumann in both 375-cu in events, and defeated all of the 550-cu in contenders but Detroyat in the Greve Trophy Race when it placed third behind Detroyat and Neumann in that order

In fact, one of the most significant features of the 1936 races was the performance increases shown by Chester's "Jeep" and McKeen's "Miss Los Angeles." Finishing the 150-mile Thompson Trophy Race at an average speed of better than 230 m p h, more than 10 m p h faster than the 1935 winning speed, the "Miss Los Angeles" still could do no better than fifth place Chester's speed of 230 479 set in the 375-cu in. class was also better than 10 m p h faster than the winning time in last year's Thompson event, but netted him no better than second place. These examples will illustrate the remarkable advances made by strut and wire-braced racers this year, an accompanying table giving a clear picture of the year-by-year speed improvement which has been shown by all of the well-known racing planes Nevertheless, on the basis of performance at Los Angeles we must return to the monoplanes with 'washed faces' for the real design lessons of the meet and leave next year to answer conclusively whether further cockpit fairing, engine cowling, wing area reduction, etc, can bring "Miss Los Angeles" and others of her ilk back into favor

Unfortunately, the plane which performed best is one of which the least is known from the standpoint of detail design However, Detroyat's Renault powered Caudron racer has been an outstanding European performer for a number of years and the general features of this machine are well known to the majority of American designers (See "L'Affaire Caudron"—AVIATION, July, 1935.) Of Detroyat's plane the most significant point is that there is no one outstanding feature which overshadows others The engine, the propeller, and the airplane itself each is a component part carefully balanced to fit into a race plane symposium which has resulted in the finest landplane racer yet developed anywhere in the world. Of low-wing cantilever monoplane design and all wood construction the Caudron is not a small plane for its power nor is it extremely heavily loaded as have been some of the American racers The fuselage appears large, but slim lines and careful joining of wings and control surfaces to the fuselage proper have kept drag at a minimum. The pilot's cockpit fairing also appears somewhat large, but a close inspection reveals extremely fine lines, allowing barely width for the pilot to turn his head, and with the enclosure merging perfectly into the fin All surfaces of the plane are perfectly smooth with a glossy finish which must add somewhat to the speed. The wing is of ample area but of very thin section and is understood to feature multi-spar construction with heavy plywood covering Certainly Detroyat did not slight the sharp pylon turns, clipping them as closely as the Americans, even when racing at 300 m p h or better, indicating that the wing structure is not so delicate as some had supposed Landing gear is operated by a compressed air bottle system, with an emergency hand pump Dual lights indicate the gear position and spare light bulbs are available for the pilot in the event of failure of those installed The cockpit is nicely finished and comfortably upholstered It can safely be said that Detroyat flew the most comfortable race of any pilot in the meet

The two pitch Ratier propeller is also air operated and is understood to have had a variation of twelve degrees between take-off and high speed positions The two speed propeller and

MAJOR AIR RACE SPEED CHAMPIONSHIPS — YEAR BY YEAR —

	1932 speed in m.p.h	1933 speed in m.p.h.	1934 speed in m.p.h	1935 speed in m.p.h	1936 speed in m.p.h.	Net m.p.h increase for period	Percentage gain for period
THOMPSON TROPHY RACE (Unlimited cu.in. displacement)	252 686	237 952	248 129	220 194	264 261	11 575	4 58%
GREVE TROPHY RACE (550-cu.in. displacement.)	171 671	196 95	213 267	212 173	247 300	75 329	44 05%
SHELL TROPHY RACE (375 cu in. displacement)	132 246	168 91	202 183	200 565	231 344	99 098	74 93%

air-operated retractable landing gear helped materially to speed up the take-offs and Detroyat was invariably the first back around the home pylon after making the scattering turn

As to the engine, or engines, used by Detroyat, he did not change engines during the meet but used the same eight-liter, six-cylinder supercharged Renault in the Thompson as in the Greve race According to the most reliable information, which was obtained direct from the French crew, the Renault engine never turned faster than 3,250 r p m , at which speed it delivered 370 hp Most of Detroyat's racing was at about 3,100 r p m. with an output of around 330 hp Like the rest of the airplane, the Renault engine is not in itself particularly remarkable or inordinately powerful for the cu in displacement Small details such as unusual development of the in-line type engine cowling, the use of skin type oil radiators, a tunnel carburetor scoop ram extending forward to the nose cowl under the full length of the engine, and other such points as have been developed by the French during years of concentration on the perfection of this particular model, explain the superior performance which completely outclassed the best of the American racers We understand that Detroyat considers his present racer obsolete and plans to return in 1937 with one capable of better than 400 m p h

No race report of recent years would be complete without giving generous mention to the designs of Keith Rider, whose racers took second and third places in this year's Thompson Trophy, rating him as number one American speedplane builder Had the modified Rider racer flown by Kling not crashed at the close of the Greve Trophy race it is very possible that it would have finished a bang-up fourth to give Rider three out of the first four awards, and place three of his designs ahead of all others of American construction Kling's Rider racer placed third in the 1935

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Photos by McReynolds

Fig 1 Michel Detroyat (right).
Fig 2 Roger Don Rae and the Rider Special
Fig 3 Mr and Mrs Marion McKeen christening the 'Miss Los Angeles'
Fig 4 Dave Elmendorff and Rudy Kling
Fig 5 Art Chester and A. S. Menasco
Fig 6. Amelia Earhart chats with the girls.

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Photos by McReynolds

Fig 7 Richard Granere, Canadian stunt pilot
Fig 8. Roscoe Turner and Mrs. Turner
Fig 9 Harold Neumann 1935 Champion with his sensational Folkerts Special.
Fig. 10. Dave and Mrs Elmendorff
Fig 11. Cliff Henderson and Sam Gates General Chairman L. A. Junior Chamber of Commerce Aviation Committee

Thompson Trophy and had shown outstanding performance in the qualifying trials this year The Wasp Rider racer flown by Earl Ortman as the "Gilmore Special" was built about two years ago but had not previously competed. This year, owned by Hal Marcoux of the Douglas Aircraft Company, the plane was completely rebuilt to Douglas standards of finish, detail refinement being introduced throughout and great attention being given to the engine installation in order to insure reliability rather than extreme speed. The plane justified such preparation when it cruised easily into second place in the Thompson at a speed close to the best previous record made in 1932 by Jimmie Doolittle Only radial powered racer in the meet, the Wasp S1D1 was completely conditioned by Ralph Bushey and an entirely new engine cowl was installed, which, together with an exhaust collector ring, improved engine cooling as well as air flow around the fuselage The plane was equipped with hydraulic retractable landing gear

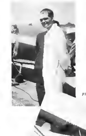
Newest of the Rider racers were the Rider Special flown by Roger Don Rae and the Elmendorff Special of Rider design which was built and flown by David R Elmendorff These planes are of substantially identical design, the Rider Special having 2 ft less span and 5 ft less wing area than the Elmendorf Special, therefore a brief description of the Rider Special will suffice for both Departing from previous aluminum monocoque fuselage construction which has featured all Rider racers, the Rider Special employed steel tube fuselage structure, with wood fairing and cloth covering Stabilizer is of stressed skin aluminum alloy sheet construction, but the remainder of the empennage is steel tube fabric covered The wing is of monospar type with one heavy beam at approximately one-third the chord and straight across spanwise from tip to tip, the wing tapering in plan form and thickness. A nearly symmetrical airfoil section is employed, with manually operated flaps The landing gear is cleverly designed so that, although attached directly to the main spar, an auxiliary steel girder across the fuselage to the forward portion of the landing gear supports relieves the spar of torque stresses due to landing loads The gear folds directly inwards into the belly of the fuselage and is completely faired in. Manual retraction was used after preliminary experiments with an electric drive. Hydraulic brakes were fitted to the Rider Special only

A cartridge type oil cooler was fitted in the upper left portion of the engine cowl, air being taken in through a tunnel from the nose and exhausting into the engine compartment proper This feature proved most desirable The engine cowling featured a venturi slot completely around the fuselage similar to the practice initiated by Howard in his racer "Mike". The engine itself was very completely baffled to permit airflow only over effective surfaces. Further improvements in engine cowling are believed possible and a better detailed design of the exit slot should improve the performance of the plane through lowered turbulence of fuselage airflow, as well as through improved engine cooling As is customary with Rider racers, the plane was not finished in time for the races, being test hopped the day before the races by Roger Don Rae. Consequently, during its first race the engine was not turning faster than 2,500 r p m and the ship did not show the speed expected By whittling a little off the propeller each night Rider was able to increase the r p m to around 2,750 still slow compared to the speed at which some of the pilots were turning the Menasco B6S engines, and the speed of the plane to an average of better than 236 m p h in the Thompson Trophy, in which the best lap speed was approximately 248 m p h , indicating that, with a little further grooming,

this plane will be a most interesting performer and may even be expected to approach the Renault-Caudron. Specifications of the Rider Special include span, 18 ft., length overall, 19 ft. height, 5 ft., wing area 65 sq.ft. weight empty, 930 lb., loaded, 1,400 lb. wing loading, 21.5 lb. per sq.ft.; power loading, 7 lb. per hp.; estimated landing speed, 75 m.p.h.; top speed, 270 m.p.h.

Most pleasing new airplane from the standpoint of design, performance, and all around excellence was the new Folkerts Special flown by Harold Neumann and built in Waterloo, Iowa, by Clayton Folkerts. This Menasco powered monoplane is fitted with a supercharged 363 cu.in. "Pirate" Model C4S engine. To understand its success it was necessary to delve a bit into history as the name Folkerts is not commonly known in the industry, though from now on it certainly should be. Clayton Folkerts came from the Monocoupe factory where he spent six years in the engineering department, having among other jobs the complete supervision of design and construction of the Monocoupe Special that was built for Colonel Lindbergh. Recently with Waco, Folkerts left to associate himself with Harold Neumann and Ted Fordon in the design and construction of the new Folkerts Special racer. Although the detailed stress analysis on this plane was performed by Fred Knack, of the Douglas Company, the design and construction are the direct work of Folkerts himself and he must be given credit for the continuous successful operation of this plane at the races. The writer made a sincere effort to photograph the plane all in one piece but this proved impossible as, during the week at Los Angeles, Folkerts kept the ship strewed all over the shop as he continually dis-assembled or assembled it in the course of his constant check on every detail of operation, condition of tanks, engine cowling, flap gear, landing gear, etc. It is encouraging for those interested in the development of racing to know that Folkerts, like Keith Rider, intends to make the construction of race planes his business.

The Folkerts Special is a mid-wing monoplane of cantilever type with cantilever control surfaces fully retractable landing gear and trailing edge flaps. Fuselage construction is of steel tubing with wood fairing and cloth covering while the monospar wing has a spruce I beam and plywood covering. The horizontal stabilizer is similar to the wing in construction while the remainder of the control surfaces are built up of steel tubing with fabric cover. The wing is interesting for its 'neutrality' tapering in plan form and tapering both ways in thickness to give no dihedral angle, while the air foil section is very close to a symmetri-



Photos by McReynolds

cal curve to reduce stresses on the single spar, and improve airflow at top speeds. At first inspection it is difficult to account for the superior speed of the Folkerts Special, as, like the Renault-Caudron, it is a rather large plane considering the engine fitted.

As long or longer than any of the 550 cu.in. racers, the Folkerts looked even larger than it was. Even so the wing area was greater than any other plane in the 375-cu.in. class with the exception of the M & A Special, which had an identical area, 50 sq.ft. But considering the clean lines of the plane with landing gear retracted, the fine streamlines of both wing and fuselage, and the light weight of only 700 lb empty, it was apparent that the design was definitely fast. This was made even more apparent in the air where, with no perceptible fuss and turning the engine several hundred r.p.m. slower than competing racers of like power the Folkerts slipped past every other plane in its class and raced in ahead of all 550-cu.in. entries except Don Rae's Rider and Detroyat's Caudron. The Fahlin propeller of wood construction, of relatively low diameter and high pitch, was obviously efficient. Of particular interest was the landing gear, which sacrificed nothing by being retractable. Of semi cantilever design the gear presented a low drag when extended permitting quick take-off, and was equipped with shock absorption for smooth landings which were

consistently made without the dangerous hopping and bouncing which characterized certain of the stiffer and closer coupled racers. The landing gear softness was further aided by the use of Goodrich low-pressure tires. Retracting backward into the belly of the fuselage, the landing gear automatically closes trap door fairing around itself, completely streamlining the fuselage in flight. When extending the gear, the trap doors automatically open and stay in proper position. Being disposed longitudinally along the fuselage, the trap doors present a relatively low drag. Also, the opening being longitudinal does not create the unpleasant drag of the usual spanwise hole in the bottom of other planes of low-wing type. The gear is operated by a crank through a chain, the same trip acting to release the gear from the locked position either extended or retracted. The operation of retraction is assisted by wind pressure, as the gear flops almost all the way up when tripped on take-off and the pilot has to exert little effort to complete the retraction. Extension is not difficult as the air pressure is partially balanced by the weight of the gear. In the event of failure to extend the gear the belly of the fuselage is reinforced for a skid-landing.

Flaps are operated by a lever control working through a slot in the fuselage at the junction of the wing trailing edge. With piano type hinges along the lower surface the flaps contribute both lift and drag when in the down position. The pilot is supplied with pure air by means of a rubber hose running from the forward part of the windshield with the intake point ahead of possible contamination by engine fumes. Thus the pilot can breath clean air even though the cockpit is filled with carbon monoxide. Appreciable improvement in cowling lines and plane performance has been accomplished by using a propeller hub extension which carries the propeller some 8½ in. ahead of the normal position on the C4S Menasco engines and permits finer lines around the engine nose cowling as well as much improved intake passages for the cooling air ducts. The propeller spinner is unique for its rounded nose, probably more efficient than the pointed spinners heretofore used. Torpedo lines of the nose carry back through to a major portion of the fuselage, the extended lower section around the engine being gracefully merged into the fuselage lines. Air for the engine side scoop is taken in through a relatively long tunnel which permits building up substantial pressure. Much the same result is accomplished over the heads by using a head scoop tunnel with individual air ducts to each cylinder head. The result has been a very cool running engine the top cylinder head temperatures being reported as around 400 deg. F., or about 100 deg. under less efficiently cowled racers. Slight ram is obtained from a carburetor scoop although this effect will probably be further emphasized by extending the carburetor intake scoop forward in emulation of the Caudron. Detailed specifications follows. Span, 16 ft.; length 21 ft., height, 5 ft. 3 in., wing area 50 sq.ft., weight empty, 700 lb., gross weight, 1,000 lb., wing loading, 20 lb. per sq. ft., power loading, 6.66 lb. per hp.

It is interesting to compare the Wittman Special "Chief Oshkosh" with the Folkerts. Wittman has an unlovely appearing plane, a square rigged, sharp cornered little cuss with funny looking cantilever spring landing gear and wire braced mid wing, with a tin cornucopia for a propeller spinner, and a piece of aluminum wrapped around the engine for a cowling. Its chief virtue has been its habit of consistently winning prize money in race after race, year after year. This year he installed a Menasco C4S supercharged "Pirate" engine in place of the Cirrus used during the past four or five years, and showed plenty of speed in preliminary trials. Unfortunately, while battling with Neumann for the lead, Wittman was forced out on the nineteenth lap of the Shell Trophy 375-cu.in. event, believed to be as a result of trouble with the propeller extension shaft which he had used. The Wittman plane will shortly be running again, probably almost as fast as Neumann's Folkerts and possibly faster than Chester's "Jeep," which he was leading when forced out of the Shell Race. The chief characteristic of the Wittman racer is the small wing and light weight of the plane. The speed attained illustrates the fallacy of supposing that super-scientific design is necessary for outstanding performance.

For all its awkward appearance, however "Chief Oshkosh" has been cleverly designed. By use of the propeller extension it has been possible to extend the engine cowling forward symetrically

NOTES

It is significant to note that the winning speed in the 1936 Greve Trophy Race is faster than any but two previous Thompson Trophy Races, and that the winning speed in the 1936 375-cu.in. Shell Trophy Race was faster than the 1935 Thompson Trophy speed.

The sixth place in the 1936 Thompson Trophy Race was taken at a speed more than 8 m.p.h. faster than the winning speed of the 1935 Thompson Trophy. Only six pilots in the history of Thompson Trophy competition have exceeded the speed of the man placing last in the 1936 Thompson Trophy event.

The relatively better improvement in speed shown in the lower power brackets is obvious from the above chart and is one of the most encouraging phases of the 1936 National Air Races. Emphasis on low power racing should bring about an even more rapid improvement in the future.

IMPROVING THE BREED

RACING FORM CHART—Showing the year-by year performances of the various racing planes in actual closed course competition. (Figures given are in each case the fastest time in closed course competition.) m.p.h.

	1932	1933	1934	1935	1936
Ben O. Howard's "Pete" 375-cu. in. class. Wright Gipsy engine	127 347	—	159 963	163 027	147 363
S. J. Wittman's "Chief Oshkosh" 375-cu.in. class. Cirrus engine *Menasco C4S engine in 1936	123 348	165 511	186 603	185 384	*215 070
Chester Special 375-cu.in. class. Menasco C4S engine	—	154 355	203 182	200 585	220 479
Miles & Atwood Special 375-cu.in. class. Menasco C4S engine	—	170 137	206 841	187 772	228 159
Folkerts Special 375-cu.in. class. Menasco C4S engine					253 074
Ben O. Howard's "Mike" 550-cu. in. class. Menasco B6S engine	191 071	190 979	211 553	213 716	223 714
King's Rider Racer 550-cu.in. class. Menasco C6S engine	157 236	181 380	211 003	213 942	227 444
"Miss Los Angeles" 550-cu. in. class. Menasco C6S engine	—	—	214 920	206 426	238 465
Rider Special 550-cu.in. class. Menasco B6S engine					236 550
Rider-Elmendorf Special 550-cu.in. class. Menasco B6S engine					234 551
Crosby Special 550-cu.in. class. Menasco C6S4 Super Buccaneer engine	—	—	—	—	229 075

at the nose, taking cooling air in through a single narrow vertical slot from which the cowling extends back smoothly into the fuselage. This feature unquestionably increases the speed and also puts air through the engine compartment under pressure to achieve excellent cooling. With a wing span of only 13 ft, area of 40 sq ft, and empty weight of 600 lb the Wittman racer is almost unbelievably small for its speed. It handles notably well on the course and in taking off and landing

One of the most interesting racers on the field failed completely to live off the gronnd

Other design lessons were to be learned in miscellaneous corners of the Los Angeles Airport Allenbaugh, trying to "supe" a little German Argus engine by raising the compression and fitting a supercharger succeeded only in burning a hole through one of the heads, and the plane never flew Wm O. Buchanan spent much time and money gearing a little 93-cu in straight-eight Miller engine 2½ to 1 to drive the prop of his Buchanan "Zipper," but the engine refnsed to run long enough at one time for a test hop. Marion McKeen did a splendid job of reconditioning the "Miss Los Angeles," incorporating many small refinements, but in raising the compression ratio of the engine for more power he passed the point where proper cooling could be accomplished and was only able to run properly by dropping back to a more modest rating. The ontstanding performance of the Chester Special was dne to the design and maintenance work of Chester himself, who has developed a propeller of his own, and uses a cantilever strut shock absorbing landing gear of efficient design and excellent characteristics.

Great interest now centers on twelve to fourteen new racers already projected for 1937, including jobs by Folkerts, Rider, and others First of the new racers will be the Roscoe Turner job being built by Lawrence W. Brown and which was originally projected for the 1936 events but could not be finished in time This twin-Wasp powered monoplane with three-blade controllable propeller will be a most interesting development. Close-coupled like an overgrown Gee Bee it will feature a mid wing of cantilever two-spar construction, with slight dihedral and absolutely symetrical airfoil. Wing loading will be very high but with Turner to fly the plane it should show ontstanding performance

Buchanan's Miller motored racer, which has never been flown.

up to advance hopes of those acquainted with its design and construction. The Crosby Racer was rushed so frantically that it never was in proper shape. It flew successfully in two races more through good luck and admirable skill of the pilot, Harry Crosby, than as the result of any pre-race grooming

Wind tunnel tests had indicated a possible 330 m.p.h. for the Crosby With the benefit of very complete preliminary design, the ship was hampered by lack of time in which to work out the usual run of detailed troubles such as surround the proper installation and cowling of an engine, action of retractable landing gear, etc The stubby wings were only 15 ft. in span as compared with a length of 19 ft 6 in Also of interest was the shock cord landing gear built to retract instantly upon release of a trigger. This plane averaged 226 m.p.h. in the Thompson Trophy, or well ahead of last year's winning time and finished fourth in the final Shell 550-cu.in. event, showing definite promise of better performance when time has permitted proper completion Handicapped by overweight (1,045 lb empty) and by inefficient propeller design, the Crosby plane was dangerously slow

Retractable landing gear on Rider Racer. Note hydraulic brakes.

Retractable landing gear on the Elmendorf Special.

Retractable landing gear on Neumann's Folkerts Special.

Photos by McReynolds

No Headaches

in flying school operation on sound business principles.

By J. B. Plosser
President Grand Central Flying School

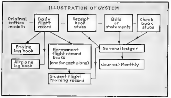
UNMARKED on California airway maps but emblazoned unmistakably on the roof of our main building is the word "PLOSSERVILLE." Geographically, Plosserville is the subdivision of busy Grand Central Air Terminal where flight instruction is given but the name means much more than just that. It symbolizes the personal nature of my relations with students,—the community spirit that has been developed among all who work or fly at the Grand Central Flying School And to this spirit among students and employees we attribute much of the success of our business

Thriving businesses do not develop of themselves, nor do they come about without headaches We have had our share and we expect more but we have kept on building our operations on sound business methods.

One of our major problems was the development of our accounting system For a long time our ideas on bookkeeping were rather primitive. We knew we were making money but we didn't know exactly how, why, or where Then we went to work to make a few changes It was a long, hard task to develop an efficient system of accounting from a vest-pocket-hip pocket type, but it had to be done Credit had to be tightened up and controlled at a time when there were substantial sums due from a clientele used to easy payment.

First we needed a permanent but simple bookkeeping system to be maintained religiously All flying sold on any basis other than cash had to be sold on contract or on limited credit to selected responsible persons Extended credit had to have a definite due date and pressure exerted to collect on that date. We found that there was nothing to fear from losing clients by bearing down on them After several discouraging years we decided to get expert assistance and called in a certified public accountant to do the job The solution was highly satisfactory

How the accounting system functions.



The accounting system

Original entries are made on four forms Flying time is entered on the daily flight record, income on the re-

ceipt book stub, accounts payable are shown on bills or statements received and accounts paid are made on the check book stubs.

The daily flight record contains the name of the student, the instructor's initial, whether the flight was dual or solo, the time of take-off and landing and the total flying time. A separate record is kept for each plane. This form is a mimeographed working sheet. All entries made on it are transcribed to permanent records. Information gained from the daily flight record is used for posting the engine and plane log books required by the Bureau of Air Commerce and another posting is made in a permanent flight record book. These include a book for each plane and each contains an itemized flight record including student's name instructor, solo or dual, and type of flight, i e, demonstration scenic or charter (revenue or non-revenue) Information is obtained from the permanent flight record books to post the flying time on the individual student flight training record This record is kept on individual cards for each student in a visible accounting file and acts as a record of accounts receivable

From the stubs in the receipt book information is obtained to post in the general ledger and from there is carried to the individual student's flight record to balance against flying time received by or due the student. Information posted in the general ledger also includes that obtained from bills or statements (accounts payable) and from the check book stubs (bills paid) Postings from the general ledger are made once a month in the Journal and balanced

Flying by appointment

For some time we had trouble in handling appointments Now we believe the problem is licked Flight appointment sheets for each of the five airplanes are carried two weeks ahead By allowing each scheduled flight of 30 minutes a period of 45 minutes and each hour flight one and a half hours, we have found that schedules could be maintained The extra time allows for slight delays in take-offs or for the running over of time in the air Unused time on the ground is consumed in preparation for flight and for preflight and post flight instruction If an appointment cannot be kept, the school calls the client immediately

To facilitate the instruction of students, a brief progress report is made out by the instructor immediately after each flight and assignments are made out for the next flight These reports are turned in to the office where they are graphically recorded on a progress chart This is done by moving a card representing the student to a hook in one of a succession of squares representing progressive phases of instruction The assignment slip is placed in a box assigned the student for that purpose Prior to the next flight made by the student he obtains his slip, reads the instructions and then makes his flight, or if he is riding dual, gives it to his instructor By this method there is no guess work involved as to the progress of the student or the assignment of his work Special care is exercised in keeping accurate flight time. An electric clock is maintained in the office for this purpose. This accuracy isn't a matter of penny pinching—it is business

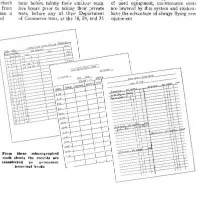
We retain two instructors at the school in addition to myself. One specializes on instrument and radio flying He also is my first assistant in taking care of other school business and supervises the maintenance of equipment Although he handles instruction other than instrument flying he is kept busy most of the time on this work and is dated ahead for no other type of instruction. The second instructor handles all other types of training, from amateur to transport

I handle the administration of the school, regularly check all students, give some miscellaneous instruction and fly most of the charter trips I check all students prior to their solo, also one hour before taking their amateur tests, five hours prior to taking their private tests, before any of their Department of Commerce tests, at the 18, 24, and 35 hour period and every 10 to 15 hours thereafter and at any other time if their instructor reports that they are making poor progress Otherwise I give instruction only when the instructors are booked up, or in special cases

A line mechanic and secretary are also kept on the full time payroll of the school The mechanic conducts all line maintenance twenty hour checks, and top overhauls All major overhauls are done by local approved repair stations The secretary maintains all the records, keeping the books and flight time record besides her secretarial work All employees work six days a week, are paid on a monthly salary basis for the full year and receive a two weeks vacation with pay Although they are all paid well, they are given a bonus when business is especially good A part time publicity man acts as an advertising adviser and assists in publicity work

Equipment Philosophy

We believe that inexpensive equipment, well maintained, is much better and more economical than expensive equipment irregularly or poorly maintained As a result, present equipment consists of two C-3's and a low wing Aeronca two Kinner trainers, two Travelair instrument flying trainers, and a Stinson S Being an Aeronca dealer we have been able to keep the newest models of the little ship on the line Although the price is dropped in the sale of used equipment, maintenance costs are lowered by this system and students have the advantage of always flying new equipment



From these mimeographed work sheets the records are transferred to permanent loose-leaf books

We are very strict in the upkeep of all equipment Instruments are not tampered with by the mechanic, but are serviced regularly, and at whatever other times necessary, by an approved instrument repair station Similarly the planes are regularly given major overhauls in an approved repair station

Student attraction

Although it is business-like our organization is not quite as "hard" as it might first appear Operations have been colored with mass cross countries, student efficiency contests, parties, and personal courtesies.

Recently our cross-country flights have developed into breakfast or overnight flights Swimming or beach parties usually furnish an objective

The efficiency contests include many interesting and original ideas All the students are grouped into three flights Each contest extends over a month of flying and is climaxed with a field day Points are given individuals and flights for hours accumulated, progression from one phase of instruction to another, and for Air Commerce tests passed The last day is field day, usually finished with a party and dance Parties and private motion picture shows have also been given separately

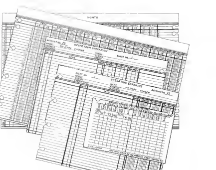
As a result of the inauguration of these attractions, student efficiency in flying increased, individual and group flying time jumped and the students displayed an added interest in their work

Many little personal touches have been developed that appeal to students Two examples should suffice to show their character Every time a student solos he is presented with the framed drawing reproduced herewith He will show it often to his friends who may be prospects for similar training Another example is the wording used in the receipt issued by the school which is reproduced in one of the accompanying illustrations This wording not only carries the goodwill of the school but its novelty has caused many of the recipients to show the receipt to friends

Consideration for both the aesthetic senses and the comfort of students has also received considerable attention Our little community consists of two small buildings set off by a neatly kept flower garden One building houses the flight office, parachute lockers, and line mechanic's shop The other building contains two rooms used as offices, two rest rooms and a well furnished student's lounge Thus we have devoted time and money to stimulate goodwill and friendship with the students Our school carries the full approval of the Bureau of Air Commerce and we consider this a valuable asset

Recent business promotion projects include cooperating with the Glendale Y.M.C.A in a membership drive by dropping pamphlets over the city, and making a plane available to a local photographer for taking aerial news photos of several disastrous fires Excellent publicity was received in each case As another business promotion, we inaugurated a special summer training course for Junior College and University students and plugged it by radio newspaper, and direct mail. As a result of this campaign, we obtained more students who enrolled in regular courses than in the special course In addition we are always ready to talk before civic groups service clubs, or similar organizations or to give a radio address.

We have found that it pays to operate on a sound business basis and that a fine business can be built by hard work We have been open-minded to new ideas and have therefore made mistakes But the good ideas have far outweighed the bad ones and we are reasonably well satisfied with the total score.



Leaves from the account books and the student flight training report

Flosser receipt

Flosser diploma

The third of three articles—

On the comparative physical properties of

SPOT WELDING VS. RIVETING

of aluminum alloys in production

By C. Weston Steward

Chance Vought Aircraft Division of United Aircraft

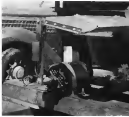


Fig. 3 Vibration test set-up

"HOW good is spot welding as compared with riveting?" This can be answered best by reference to the accompanying curves. Spot weld shear strengths increase somewhat in proportion to the thickness of stock whereas rivet strengths are approximately proportional to the stock thickness until the shear strength of the rivet is reached, after which the thickness of stock makes no difference. Fig. 1 shows a comparison of spot weld shear strengths with rivet shear strengths with AN Std. 17ST Brazier Head rivets in 24ST stock and 24ST Alclad for the spot welding. The values for the rivets shown in Fig. 1 are obtained from actual test results in each case. The spot weld strengths are not the maximum possible under ideal conditions, but are averages which can be obtained in actual production by properly trained and conscientious operators.

Spot welding may be said to compare favorably with riveting in shear, but it is definitely inferior in tension (Fig. 2). The low strength in tension is to be expected because a spot weld is in reality a headless rivet. Compared with flush rivets (where the sheet is drill countersunk), the spot welds are not so bad, but a fairer comparison would be with press countersunk, flush rivets which are capable of developing as good strength in tension as are brazier head rivets. In defence of spot welding, however, it may be said that few joints are designed with rivets in tension, so there are not many places where riveting has a marked advantage over spot welding.

Effect of Vibration

There seems to have been considerable doubt as to the ability of spot welding to stand up under vibration. In order to find out something about this condition the author had a small section made which resembled the leading edge of a stabilizer or elevator. In this section the ribs and leading edge reinforcing strip were spot welded to the skin and all other joints were riveted. The section was mounted as a cantilever (Fig. 3). By means of an arm-link-eccentric hook-up to a synchronous motor, a bending moment of 2,400 in. lb. and a torsional moment of 2,000 in. lb. was applied each revolution of the motor. The calculated maximum shear stress in the skin was 5,000 lb. per sq. in. The r.p.m. of the motor, as checked by a stroboscope, was 1,700. Fig. 4 shows the wrinkles developed in the skin when under load. Final failure occured in the skin as shown at A in Fig. 5. It will be noted that there is also a crack in the skin under the edge of one of the rivet heads (B, Fig. 5). All of the spot welds were apparently intact. Perhaps the best indication of the ability of spot welding to withstand vibration is the fact that hundreds of thousands of spot welds have been made in engine cowlings by Chance Vought Aircraft have established an excellent service record.

Corrosion

The next important phase of the subject is corrosion resistance. Tests were conducted by Chance Vought Aircraft, at the request of one of its customers, to determine the relative merits of spot welding with various materials compared with riveting. The specimens were made up as follows:

1. *Riveted*—Two plates of plain 17ST. Finish consisted of anodizing and two coats of lead chromate primer applied to each faying surface before assembly. 17ST rivets.
2. *Spot Welded*—Both plates 24ST Alclad. Anodized after spot welding. No other finish.
3. *Same as 2*—except 24ST Alclad and 5S plates.
4. *Same as 2.*—except 24ST Alclad and 3S plates.

Three samples of each were given an alternate immersion test of the accelerated type used by the Aluminum Company of America. The results at the end of twenty hours are shown in Fig. 6. There was absolutely no corrosion of the spot welded samples either on the surface or between the plates, whereas the riveted samples showed definite signs of corrosion on the rivets and breakdown of the anodic film on the outside surfaces of the sheets. It has been the practice at Chance Vought Aircraft to dip spot-welded assemblies in lead chromate primer and apply two coats of Dulux in addition to anodizing. The test, described above, on the unpainted samples was probably equivalent to 2,000 hr. in a salt spray.

Considering the variation in shear strength from an average value, the author has found that the variation is approximately ± 10 per cent in any one batch of samples which have been aged a sufficient length of time. If tested immediately after welding this variation may run as high as ± 15 per cent to ± 20 per cent. A reasonable average of ± 15 per cent may be assumed to cover the variations to be expected in production. In Wright Field Report M-56-2597 the allowable variation between maximum and minimum is given as 5,000 x thickness of stock, which, for .020 in. would be 100 lb. or ± 50 lb. from an average. Based on their strength of 212 lb. this represents an allowable variation of ± 23.6 per cent. Aging has a pronounced effect on both shear strength and variation. Fig. 7 shows that full strength is not developed until about six days after welding, and that only about 70 per cent is developed immediately after welding. Likewise it has been found that the variation between maximum and minimum is reduced more than 50

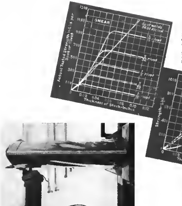


Fig. 1 Left. Comparison of spot welds and rivets in shear. Sheet stock 24ST Alclad. Rivets are Standard AN Brazier Head. 17ST

Fig. 2 Below. Comparison of spot welds and rivets in tension. Sheet stock is 24ST Alclad. Rivets are Standard AN Brazier Head, 17ST.

Fig. 4 Vibration test specimen under load

Fig. 5 Vibration test failure.

per cent in six days aging compared with that found at the end of 24 hr

Fig 8 shows the strength of spot welds in torsion Although these values might be considered low it should be kept in mind that spot welds are practically never subjected to torsion so this information may be classed as interesting but not important. Somewhat allied to torsional strength is angle of twist It seems that the yield point occurs at approximately 5 deg (for 24ST Alclad) regardless of the thickness of stock The strength drops off at this angle to about 60 per cent of the maximum and then tapers off to zero in the next 5 or 6 deg

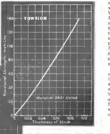
Variations

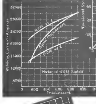
There has been a general impression that when two different thicknesses are welded together the welding machine settings should be based on the thinner of the two sheets The author believes this to be true only as regards the electrode pressure and time of current flow Using the pressure which is based on the thinner sheet and a timing of 10 cycles the weld amperages are found to vary in the manner shown in Fig 9 In preparing the data for these curves the amperages required for equal thicknesses were recorded at the same time and under the same test conditions as for the different combinations of thicknesses It will be noted that these indicated amperages are slightly lower than those shown in Fig 3 of the previous article (AVIATION, Sept, 1936) This is due to a new upper electrode and horn being used which are more efficient than their predecessors The actual weld amperages were undoubtedly the same but the auto-transformer tap settings required were lower

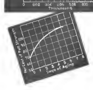
Regarding the welding of other materials than 24ST Alclad, the author finds that for the thin gages the amperage required is nearly proportional to the electrical conductivity of the material. As the thickness of stock increases, the difference in required amperage decreases. When a material such as 3S is welded in combination with 24ST Alclad the "bubble" will not be symmetrical with reference to the faying surface as a center line The segment in the 24ST will be larger than that in the 3S due to the greater electrical resistance of the 24ST. In order to counteract this effect it is necessary to vary the shape of the electrodes For example, in the case cited, a flat tip on the 24ST side and a rounded or conical tip on the 3S side would be used

In the foregoing three articles the author has presented a resumé of all the data which, to his knowledge, is available It is hoped that these articles will serve as a guide to those who have had no experience with spot welding aluminum alloys and will encourage further research and discussion by those who are interested in the development of the art

Fig 7 Bottom Effect of aging on shear strength
Fig 8 Right Strength of single spots in torsion
Fig 9 Below Variation in weld amperage required when combining different thicknesses.







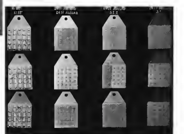
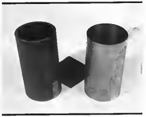


Fig 6 Results of comparative corrosion test of spot welding vs riveting

Improved materials and better manufacturing technique have eliminated many of the variables that originally justified holding limiting allowable stresses for design of seamless steel tube structures below actual performance—so

Why Not Raise the Ante?



Five years progress in steel tube.

asks **J. P. Boore**
Vice-President, Summerill Tubing Company

PERIODS of industrial depression are usually marked by unusual advances in the productive arts Prominent among those products which have been favorably affected by the beneficial influences of improved manufacturing technique is seamless steel tubing

Within the span of depression years have come improvements, not only in the practice of making the steel itself, but also in the art of converting that steel into tubing There is scarcely a single step in the entire process which has escaped critical examination in the past seven years There is scarcely an operation which has been subjected to this close scrutiny but has been improved.

To deal with the specific changes and their individual affects upon the product is not the purpose of this article Our interest is in the accumulated affects of these changes upon aircraft tubing Our concern is how best to present these improvements in present day aircraft tubing without subjecting ourselves to the suspicion that we are simply trying to pull rabbits out of a hat

Perhaps the best approach to the subject is to make direct comparisons between aircraft tubing as it was some years ago and as it is today We need not tax our memories to do this Some tubing purchased in the frenzied days of '28 and '29 remains in stock, some of it with identifying marks indicating that it was government service inspected and accepted Its original condition has been preserved Its mute testimony affords an illuminating contrast.

Pictured above is a piece of the old tubing and beside it a piece of the new Both pieces were produced in our own plant, one by the processes employed several years ago and the other by the process employed today Note the rough mottled appearance of the one as compared with the other While not plainly discernible in the photograph, the mottled appearance of the one specimen is due to scale and pits, some of which cause local reduction of the wall thickness by as much as 10 per cent.

Scale, common to the old tube, might represent 1, 2 or, in an extreme case, as much as 3 per cent of the total weight Oxide free tubing, as now being produced, has no scale and every ounce of weight is an effective load carrier.

Pits, scratches and other surface imperfections, characteristic of the old tube, became points for localizing the stresses to which aircraft structural members are subjected Also their inviting cavities provided a convenient lodging place for acids encountered during process pickling Washing and neutralizing fluids, lacking the penetrating power of the acid, could not reach the depths of the multitude of pits Residual acid remained even after the coating oil was applied with the result that the effective area of the tubes was still further reduced by progressive corrosion which proceeded even under the protective coatings of primer or oil

The smooth clean surface now produced on aircraft tubing affords no such starting point for corrosion True, if unprotected, it will rust, but with no deep pits there is no way for acid or moisture to remain under the oil or primer

Physical Properties

The discussion of physical properties may well be started with a question Why is 60,000 lb per sq in the maximum allowable compressive yield strength for normalized Chrome-Moly tubing? Was this value used some years ago? If so, and if tubes of those days safely supported the loads for which they were designed, it would seem that higher stresses might safely be permitted today

Army and Navy Specification now provide that the minimum yield point for normalized Chrome-Moly tubing is 75,000 lb per sq in for sizes $\frac{1}{16}$ in wall thickness and lighter These revisions were adopted in 1932 Since then the tubing has been manufactured to these higher physicals

Based on the former yield point of 60,000 lb per sq in these new physicals reflected an increased value of a full 25 per cent. That immediate advantage was not taken of these higher physicals in aircraft design and stress analysis is probably due to several factors

At the time of the change there were extensive stocks of tubing in the hands of aircraft builders, in the stocks of steel jobbers and in the stocks of the mills themselves. No doubt it was felt that a reasonable period should elapse to permit this old specification material to be consumed before the 25 per cent increase in physicals should be reflected in design. It seems, however, that sufficient time has now elapsed so that very few of the old stocks remain and those that do are probably tag ends of miscellaneous lots whose origin or exact quality would be subject to question

Possibly it is because the Army Handbook still shows the lower yield point as being the maximum allowable yield strength under compression

Probably the tubing manufacturers are to be critized for not having placed more emphasis on the change and its benefits. Certainly there seems no good reason why newly manufactured material, guaranteed to conform to the higher physicals and supported by notarized test reports, may not be used to full advantage.

Actually the yield point of tubing now being supplied under present government aircraft specifications usually runs 85,000 lb per sq in or over. The specifications could be changed today to require 85,000 lb per sq in minimum yield point on Chrome-Moly tubes $\frac{1}{16}$ in wall thickness and lighter and the manufacturers could meet the specification

We are told that although a higher specified yield strength of 85 000 lb per sq in might not greatly affect tension members, which are usually welded, the design of compression members, on the other hand, would be affected markedly

The chart shows three sets of curves. One is for 60,000 lb, one for 75,000 lb and one for 85,000 lb per sq in yield point

These are based on the Johnson-Euler formulas Whether these curves accurately portray present day values we do not know Perhaps the improvement in the mechanical aspects of tubing as referred to earlier in this discussion might change the picture The smoother surface and greater homogeneity of the metal might afford different values than reflected by the Johnson parabola.

It seems timely, therefore, to suggest that the entire subject of tubing be reopened and that a new series of empirical tests be made to determine to what extent modern technique may permit an increase in the allowables

Other Safety Factors

Under the conditions existing five and more years ago it was essential that unusual precautions be taken and extreme safety factors provided That few failures have ever occurred in tubular constructed planes attributable to structural weakness is able testimony that those safety factors were amply adequate Is it not timely now to inquire whether those safety factors, erected years ago to satisfy some conditions which no longer prevail do not now constitute an unnecessary barrier to the more extensive use of tubing? We think so

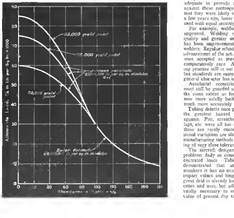
Safety factors are designed to provide against certain unpredictable and unappraisable contingencies, including variations in welding technique, unintentional eccentricity of loading; variations in tubing physical properties; variations in tubing size; tubing defects, and corrosion hazards in service These factors simply have to be adequate to guard against the accumulative effect of those contingencies being encountered simultaneously Since it is apparent that all the safety factors which have been used were adequate to provide ample protection against these contingencies to the extent they were likely to be encountered a few years ago, lower factors might be used with equal security today

For example, welding apparatus has improved. Welding rod is of better quality and greater uniformity There has been improvement in the skill of welders Regular schools teach the latest advancement of the art. Welding cracks, once accepted as inevitable, are now comparatively rare Admittedly, welding practice still is not uniform enough but standards are more exacting and its general character has improved

Accidental eccentricity of loading must still be guarded against but not to the same extent as formerly Jigs are now more solidly built and hold tubes much more accurately than formerly

Tubing defects once probably provided the greatest hazard to be guarded against. Pits, scratches, scale, cracks, laps, etc were all too common Today these are rarely encountered Dimensional variations are also rare as modern manufacturing methods permit the meeting of very close tolerances

The aircraft designer is facing new problems daily in connection with concentrated loads Tubing has already demonstrated that among structural members it has no near equal for high impact values and long fatigue life A great deal is already known about properties and uses, but additional tests are vitally necessary to establish the real value of present day tubing



New Light on the PANEL PROBLEM

A study of allowable compression in aluminum alloy sheets.

By Ernest J. A. Greenwood, Jr.

Sikorsky Aircraft Division United Aircraft Corporation

In the November and December 1935 issues, AVIATION published a discussion of allowable stresses in aluminum alloy panels by Prof. J. S. Newell of M. I. T. The author of this article, in developing his "apparent width" method of panel computation, has derived many of his basic principles from Prof. Newell's work.

THERE have been many attempts, from both the theoretical and experimental approaches, to predict the load which can be carried by a flat sheet in end compression if the sheet is simply supported along its edges. The most popular method is that which was developed by von Karman (Ref 1) where the load carried by a sheet may be expressed as

$$P = C\sqrt{E\,\sigma_y}\,t^2$$

where P is the ultimate load on the sheet in pounds

E = the modulus of elasticity in lb. per sq in

σ_y = the yield point in lb per sq in.

t = the thickness in inches

C = a constant

Theoretically this should apply to any material, but actually C varies over such a range that the method does not permit close design

At M I T this expression was taken by J S Newell, typical values were inserted, and the expression

$$P = 1.06 \times 10^6 \times t^2$$

was developed for the ultimate load which could be carried by flat aluminum alloy panels in compression (Ref 2 and 3) This gives very good agreement with test results for the normal range of widths and thicknesses which might be met in small designs, but on thick sheets (over .050 in.) the widths may be such that the expression will not give close agreement For example, on a .032 in. sheet, the loads carried by a 3 in width and a 12 in width are almost identical, while on a .052 in sheet there is about 18 per cent difference in the loads, and on a .072 in. sheet the difference is 30 per cent. This would indicate that the expression is not satisfactory for sheets of thickness greater than .040 or .050 in. Some sort of a width correction factor is obviously necessary for these gages While these thicknesses are not the most common ones met in design, they are coming into more general use in large airplanes, so that some attempt must be made to predict the allowable stresses on such sheets if an efficient design is to result

In the majority of cases the ultimate load which a sheet will carry is not all that is wanted Compression loads usually arise from bending conditions, and it would be highly advantageous if the conventional beam theory could be employed in the computation of the bending stress While the bending moment is usually known, it is desirable from a design standpoint to obtain values of the moment of inertia of the structure in order that the compressive stress due to bending may be determined To do this the effect of the skin must in some way be taken into account if we are dealing with a stressed skin type of structure.

The popular method is to assume arbitrarily that a strip of skin equal in width to a definite number of thicknesses acts as a column along with a stiffener As used, the ratio of effective width to thickness is taken as a constant for all widths and thicknesses of sheets, and there is some controversy as to what the value of this ratio should be This procedure is satisfactory if the range of widths and thicknesses employed is not large, but if the variations are large, the ratio can be shown by tests to be a variable, and the method tends to break down

An attempt has been made to rationalize this method and to expand it to cover any range of thicknesses and widths of panels which might be met in design This has led to the apparent width method which is presented here

For flat sheets in end compression the load distribution has been shown by von Karman (Ref 1) to be as sketched in Fig 1 The sides of the sheet, being simply supported, can carry loads until the yield point of the material is reached The center of the panel, however, not being supported, buckles at a lower stress, and may very quickly reach a stage where it can carry no more load. In all cases of good design, this is the condition which exists, but just what the stress is at the various points in the sheet may be very difficult to determine

For any thickness of sheet there is a definite width of panel beyond which increases in width will cause no further increases in the load carried (Ref 4) On thicker sheets, however, due to considerations other than those of purely a compression nature, the width of panel used is often less than the critical width, and the load which the sheet will carry is difficult to determine if the theoretical distributions are used

To take care of this possibility, assume that the load distribution (stress distribution also) is according to Fig 2 W_a is termed the apparent width of the sheet acting For any thickness and

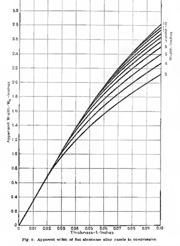


Fig 3: Apparent width of flat aluminum alloy panels in compression.

width of panel the apparent width will have a value such that it carries a compressive load until the yield point of the material is reached, when failure of the entire panel occurs Fig 3 gives a family of curves by means of which the apparent width of any flat aluminum alloy panel may be found if the true width and thickness are known. Then the ultimate compressive load which the panel will carry may be determined by the equation

$$P = W_a t \sigma$$

where P = the ultimate load on the panel in pounds
t = the thickness of the panel in inches
W_a = the apparent width of the panel in inches (Fig 3)
σ = the yield point of the material in lb per sq in.

The apparent width of the sheet is in all cases greater than the width of sheet at the sides of the panel which is highly stressed according to von Karman's theory. This is because the load on the center of the panel is assumed to be "piled-up" at the sides of the sheet to make the uniform distribution

The apparent width has no actual significance, being very similar to the well known modulus of rupture for wooden beams and steel tubes. The curves have been drawn to fit the test data for flat unstiffened panels which are given in a number of the references so the introduction of the concept of an apparent active width of panel gives such excellent results that the stratagem seems justified The method is perfectly safe for use in design because a true distribution of any load below the critical load for the panel as obtained by the method of apparent widths would not produce a failure of the panel

Fig 3 gives the apparent width of sheets acting for the range of widths and thicknesses of panels usually met in design. Although many tests have been run on stiffened and unstiffened panels of smaller widths no attempt has been made to include these results, for it is felt that they would not be met in ordinary design

Table 1 gives a comparison of the predicted and test loads on a series of flat unstiffened panels The agreement is very good and if all the tests on aluminum alloy panels in these two references are considered, the average error will be found to be about 4 percent, or well within the limits of variation of the properties of the material and experimental error.

The distribution of load on a flat sheet as predicted by von Karman has been shown by photo-elastic studies to be correct. A comparison of test results

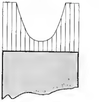


Fig. 1. Stress distribution in a flat panel under end compression with sides simply supported, according to Ref 1

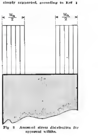


Fig 2 Assumed stress distribution for apparent widths.

and an expansion of the theoretical equations involved seems to indicate that the principal effect of curvature is to increase the strength of the panel by increasing the width of the highly stressed portion near the supported sides and also by raising slightly the buckling strength of the unsupported center portion This stiffening effect has been shown by Sechler (Ref. 6) to be a function of the radius, thickness, and width of the specimen, but to be independent of the length

If we take the total load on a curved panel and apply it as a uniformly distributed load over the sides of the panel in the same manner which was employed for the flat sheet, an apparent width will be obtained for the curved specimen A detailed study and comparison of a large number of tests has shown that for radii of over 10 in, the apparent width of a curved panel may be expressed as a function of the apparent width of a flat panel with the same width and thickness. The curves in Fig. 4 are provided to determine this relation if the dimensions of the specimen are known. The curves can be seen to depend upon the width and the radius (r) for their values which seems to be contradictory to previous theories which have given the ultimate compressive load on a curved panel in the form

$$P/A = KE\,t/r$$

The flat sheet results which are modified for the effects of curvature, however, vary with the thickness, so the result is of the proper form, and K is a function of the width of the panel.

The predictions for the allowable loads on unstiffened curved panels show their greatest discrepancies when the width of the panel is very great (over 12 in) and the radius of curvature is small (under 10 in) This would seem to indicate that the form of the curves is not absolutely correct (some function of the width and radius probably being omitted) but the agreement between predicted and test results over the range of practical design is very good

This method contradicts the method which has been proposed by Newell in that it assumes the load on a panel to be independent of the panel length Theoretical considerations (Ref. 6) lead to the same conclusion, although a complete set of test results seems to substantiate Newell's proposal (Ref. 2). The only explanation which can be offered is that the type of support used in the tests (rather than the length of the panel) produced the variation noted Nearly all tests on unstiffened panels have been made with an edge support which stops some distance from the loaded edge of the sheet in order to take care of deflection in the length direction. As the length increases, this unsupported length must also increase, and nearly all failures on a long panel will occur in this unsupported length. For a stiffened panel where the edge support is made up of a stiffener section, no noticeable decrease in the load carried by the sheet occurs as the length of the panel is increased The actual load carried by the stiffened panels falls off as the length increases, due to the column action of the stiffener section, but this effect has been taken into account

For predicting the loads on stiffened panels, whether flat or curved, the method suggested by Newell is used This assumes complete independence of action of sheet and stiffener except that the stiffeners are assumed to give simple support to the sheet This method consists of adding together the ultimate load which would be carried by the stiffener when tested alone and the ultimate load which would be carried by the sheet acting alone with simply supported edges The load which would be carried by the sheet may be readily determined by means of apparent widths

Tables 2 and 3 give a comparison of the predicted and test loads on a series of flat and curved stiffened panels. The agreement is excellent except in the case of the 18 in, highly curved, thick panel. In this case the sheet became so strong with respect to the stiffeners that the stiffeners were not able to break the sheet up into simply supported panels as was expected Any rational design, however, would not contain such a disproportionate sheet-stringer combination. The stiffener sections used were a J-section (Type 1) and a channel section (Type 2).

TABLE 1 PREDICTED AND TEST LOADS ON FLAT UNSTIFFENED SHEETS

Reference	Length	Width	Thickness	W_a	P theo.	P test	% Diff
4	24	8	.015	.525	283	300	+5.7
5	12	8	.021	.720	618	600	−3.0
5	12	4.5	.032	1.09	1425	1410	−1.6
4	24	8	.043	1.45	2260	2200	−2.7
5	12	4.5	.052	1.58	3360	3440	+2.3
4	24	12	.0606	1.96	4280	4100	−4.4
4	24	12	.0732	2.28	6000	5950	−0.8
4	24	8	.0898	2.00	6430	6800	+5.4
4	24	8	.0893	2.40	8000	7950	−0.6
5	12	8	.092	2.39	9000	9000	0

For reference #4 σ = 36,000 lb. per sq.in
For reference #5 σ = 50 900 lb. per sq.in

TABLE 2: PREDICTED AND TEST LOADS ON FLAT STIFFENED PANELS

Reference	5	5	2	2	2	2	2	2
Thickness	.021	.033	.016	.016	.033	.033	.052	.052
Width	8	12	18	12	12	12	12	12
Length	12	12	6	18	6	18	6	12
Width of panels	3	6	6	12	12	12	4	6
Number of stiffeners	1	1	3	2	2	2	4	3
Apparent width	.73	1.70	.58	.68	1.18	1.13	1.53	1.67
σ sheet	40,900	40,900	36,000	36,000	36,000	36,000	36,000	36,000
Load carried by sheet	1250	7380	900	450	1340	1340	8590	8250
Stiffener section	#1	#1	#2	#2	#2	#2	#2	#2
Load per stiffener	3000	3000	1550	880	1550	1000	1550	1300
Total theoretical load	4250	10380	5550	2210	4440	3340	14790	12150
Test load	4325	9850	5300	2375	4400	4190	15000	9720
Percent difference	+1.7	−5.1	−4.7	+6.8	−1.0	+5.0	+1.4	−4.4

TABLE 3 PREDICTED AND TEST LOADS ON CURVED STIFFENED PANELS

Thickness	.0190	.0190	.0310	.032	.0330	.0520	.0520	.052
Length	6	18	6	12	18	6	12	18
Radius of curvature	30	10	10	20	30	30	16	10
Number of stiffeners	2	4	4	3	4	3	2	4
Width of panels	12	4	4	6	4	6	12	4
Flat apparent width	.66	.66	2.11	1.20	1.11	1.67	1.72	1.53
Curvature factor	1.60	1.15	1.15	1.30	1.08	1.10	2.30	1.15
Total load on sheet	675	1555	4550	3380	4100	6880	8050	9000
Load per stiffener	1550	880	1550	1300	880	1550	1300	880
Total theoretical load	3775	5075	10750	7280	7620	11530	10650	13420
Test load	3750	5200	11240	7480	8000	12200	10620	10520
Percent difference	−0.6	+2.4	+4.3	+2.7	+4.0	+5.4	0	−27.8

All data taken from reference #2. For all specimens total width is 12 inches σ is 36 000 lbs/sq. in. stiffener is type #2

Although few destruction test reports on stressed-skin structures have been published, an examination of the available information by means of the method of apparent widths has proven very interesting. Consider a fuselage or stressed-skin wing type of structure under the action of a bending load. On the tension side of the structure all the skin will be effective in carrying the tension stress due to bending. On the compression side only that material which is near the spars or near some other stiffener running normal to the bending moment vector will act at very high stresses. By means of the apparent width method, a width of skin acting with such stiffening members may be found, and the moment of inertia of the entire cross-section may be determined by using all the skin on the tension side and the apparent widths on the compression side. Such a procedure is a trial-and-error method. Familiarity with any one structure, however, permits one to estimate the neutral axis closely.

When the moment of inertia is known the conventional beam theory may be used to determine the fiber stress. If this stress is turned into a load by multiplying it by the area at the most stressed fiber, it may be compared to the allowable load as determined by the apparent width method to determine whether or not the structure possesses sufficient strength. The area at the most stressed fiber for this computation is the sum of the stiffener area and the area of the effective width of skin.

If the allowable stress on the stiffener section involved is over 25,000 lb. per sq.in. such a method gives very good agreement with test data for stressed-skin structures subjected to bending. For the present, such an approximation must be thought of as only an approximation giving perfect results if the allowable stress in the stiffener and the yield point of the skin are the same, but being more and more in error as the allowable stress in the stiffener decreases. For those tests which have been considered (Ref. 3) this method gives fair agreement between computed and test results. Further investigation of this point is undoubtedly needed but the method may be safely applied in the determination of the actual stresses in a structure subjected to bending forces if the approximations involved are constantly kept in mind and provided for.

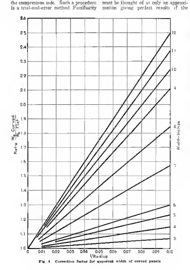


Fig. 4 Correction factor for apparent width of curved panels

Conclusions

1. For unstiffened aluminum alloy panels, both flat and curved, the method of apparent widths gives agreement with test results for the allowable compression on the panels which is within the limits of variation of the properties of the material.

2. The method is applicable to any aluminum alloy provided that the correct value of the yield point is known. For 17ST, a value of 36,000 lb. per sq.in. is suggested; for 24ST, 40,000 lb. per sq.in. is satisfactory.

3. For predicting the allowable load on stiffened panels the method suggested by Newell is satisfactory, provided the design is good. To find the allowable load on the sheet for use in this method, apparent widths may be employed with good results.

4. By good design is meant that a stiffener shall be stiff enough to break a sheet up into panels and then lend them simple support. Most designs which would arise in normal practice would be in the "good" or satisfactory region.

5. While the method of apparent widths gives excellent results in predicting the allowable compression loads on a stressed-skin structure, it should only be used as an approximation in computing the moment of inertia and the actual loads in a structure unless the allowable load on the stiffener is over 25,000 lb. per sq.in., in which case the approximation becomes very good.

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Editorials

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ATLANTOMANIA

► No one who has been reading AVIATION in the past few months can doubt that we have more than a passing interest in the problem of over-ocean air transport. We believe that no more important chapter will ever be written in the economic history of the world than the story of the conquest of the oceans by aircraft. We look back with pride on the many articles on the subject that have appeared in these pages, and we look forward to future opportunities to record the continued progress of inter-continental air commerce.

We run no risk of being misunderstood, therefore, when we are constrained to deplore the survival of a state of mind (which should have been long since extinct) that sends a Beryl Markham out over the Atlantic alone, without radio in the face of definitely bad weather, or induces a night club celebrity to barge off with a cargo of ping-pong balls.

Ten years ago there might conceivably have been some justification for such attempts. Today we can see none whatever. Few possible technical or scientific benefits can accrue. Few data of any value toward commercial operations can be gleaned from their records. The only possible interpretation we can put on such attempts is a misguided search for personal publicity.

That the risks are great is well known. How close both attempts came to failure is a matter of record. If only the necks of the participants were involved we might feel some concern, although we might possibly feel that, after all, it was their own business. But there is much more than that at stake. At a time when public confidence is needed to back up legitimate trans-oceanic projects there is everything to lose and nothing to gain in the taking of such unnecessary risks.

In quite another category is the splendid work of the Lufthansa pioneering flying boats, Zephir and Aeolus. The record of their flight appears elsewhere in this issue. To their company and to their crews, our congratulations. It is only with such sound preparation, adequate equipment, and the exercise of good judgment, that the oceans will be conquered. Foolish and foolhardy efforts of publicity seekers will do nothing but obstruct the path of progress.

50 MILLION FRENCHMEN—

WERE NOT WRONG when they backed Detroyat's chances to clean up in a big way at the National Air Races. Of course, right there lies a part of the reason for his success. Whether they knew it or not, all of the fifty million had contributed, for the Caudron racer comes of a long line of specialized ships that have been helped along for years by generous assistance from the French Government.

The boys on this side of the water who sat up nights and denied themselves not only the luxuries but even some of the necessities of life to get their race entries in shape to compete, rate a lot of credit. They put up a gallant show, but the cards were stacked against them.

But we cannot hold with those who have written us more or less violent letters denouncing the French participation as unfair. After all, the race was open, and the French simply sent over an outfit that was just a little bit better than anything anyone here had on hand. If there is any moral in it, it is simply that if we are to have races at all, both the government and the industry will have to dredge up enough interest and put up enough money to meet competition from all comers.

For years we have been trying to find some reason to justify the continuance of the National Air Races in their present form. Last year at this time we felt pretty low about it. This year we do not feel much better. True, performances were noticeably improved and some new and interesting designs appeared, but the races were still run off on the old ballyhoo basis, and no matter how thick you slice it it is still ballyhoo.

But if "L'Affaire Caudron" provides the impetus that will lead to something really worth while, perhaps there is yet some hope. We understand that Detroyat is planning to come back next year with something much faster than his this year's entry. There is a joint challenge here for the American government and for American builders, and upon how they handle it will depend the future of air racing in this country.

EXPORT MARKETS

PRELIMINARY estimates of the volume of aeronautical exports from the United States for 1936 point toward substantial increases. Although the 1935 volume dropped below the record peak set in 1934, if business continues at its present rates the chances are good that this year will run well ahead of both.

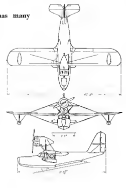
Seldom before have prospects for export sales been so bright. Many of the countries of Europe who have enjoyed substantial monopolies for their aeronautical products in certain sections of the globe are now so busy turning out military equipment for their own use that they have no time to think of supplying the demands of the smaller nations who do not have manufacturing and design facilities of their own. There is always a certain amount of demand from such people for military equipment which can legitimately be met with equipment released by our own government for export, but there is also an important and rising demand for commercial equipment all over the world. Now if ever is the time for our manufacturers to devote much time and effort to the promotion of their products in world markets.

Flying Equipment

What's new in aircraft, engines and major accessories

Fleetwings Sea Bird

Shotwelded, all stainless steel amphibian has many interesting and novel features.



FOR the past six or eight months it has been our privilege to stop in occasionally at the Fleetwings plant in Bristol (Pa.) to watch progress on the construction of what is to us one of the most interesting aeronautical projects that we have seen for a long time. Carl de Ganahl and his chief engineer, W. A. Sutton (both well known to readers of AVIATION) have succeeded in transferring their longstanding belief in stainless steel as an aircraft material into reality in the form of the amphibian "Seabird," the first completely engineered stainless steel job in the world. Readers will recall that the late American Aeronautical Corporation converted an all-wood Savoia-Marchetti design into stainless steel some three years ago, but the Seabird is the first attempt to design from scratch in stainless steel.

Very recently we were privileged to watch the ship through some of her early test flights in the hands of Daniel Brimm, veteran seaplane pilot. Brimm's long experience in getting seaplanes in and out of the waters around New York has made him a competent judge of water handling and flying qualities.

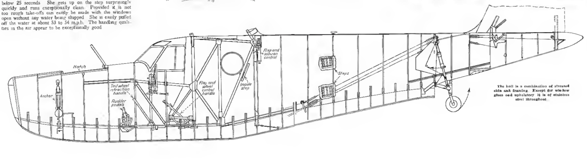
The ship handles exceptionally well on the water, using a streamlined tail wheel of slightly over 13 in. in diameter directly connected to the rudder pedals as a water rudder. This tail wheel is independently retractable by a lever alongside the control column. Her take-off with pilot only and full tanks has been clocked at 8 seconds on glassy, smooth water with no wind. With full load and no wind her take-off is below 25 seconds. She gets up on the step surprisingly quickly and runs exceptionally clean. Provided it is not too rough take-offs can easily be made with the windows open without any water being shipped. She is easily pulled off the water at about 53 to 54 m.p.h. The handling qualities in the air appear to be exceptionally good

Externally the most interesting treatment is of the main landing gear. One of the photographs on the next page shows the mechanism of retraction and in one of the flight photographs can be seen the position assumed by the wheel in flight. This appears to be quite a satisfactory solution to a troublesome problem. Wind tunnel tests have indicated that the drag is very low and there appear to be no disturbing aerodynamic effects from interference or other causes. The wheels are in full view of the pilot at all times. The operation of the gear is simple and effective from a hydraulic hand pump.

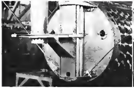
The most interesting features of the ship, however, are in her structural arrangement. Stainless steel, shotwelded throughout, is used throughout except for the fabric that covers the wings and tail surfaces. The hull, as shown by the drawing and accompanying pictures, is a combination monocoque and framed type. Stresses in the central portion surrounding the passenger compartment and carrying the wing fittings, landing gear mechanism and nacelle mounting, are carried by means of built-up steel tubes. The method of joining the tubular members and of applying fittings for the bracing wires and other parts of the structure is most ingenious as may be seen from an accompanying photograph. Fore and aft of the cabin section, a true monocoque is used. Cross-section shape is maintained by the use of light former rings, tied together fore and aft with light stringers to which the steel skin is shotwelded. The method of building up the hull bottom shows clearly in the photograph on page 41.

The wings, under the fabric covering are all stainless steel. They are of the two spar type with relatively light intermediate ribs and built up drag struts and double diagonal tie-rod bracings. The spars are of the box type with webs and caps corrugated longitudinally and provided with frequent internal stiffeners. Flat plates, shotwelded

Above: When in flight the landing gear retracts so that wheels are in the position shown. Below: Fleetwings Seabird on the ramp at the Bristol factory

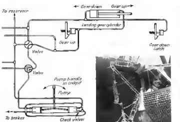


The hull is a combination of stressed skin and framing. Except for window glass and upholstery it is of stainless steel throughout.



Detail of rudder post with tail cone removed. See next page for complete tail assembly

Interior construction in the cabin in the section where loads are carried both in the skin and in the framing



Schematic layout of the plumbing system which supplies hydraulic power for landing gear retraction and flap operation.

Right: How the landing gear retracts. The sketch shows a wheel in a partly retracted position. The wheel pants and the covering strips on the struts have been omitted in the sketch for simplicity. The operating cylinder is fastened along the front face of the front spar. The pivot point is on the front spar also

Typical wing fittings showing section of the rear spar flying wire attachment fittings and hinges for the ailerons.

against the webs, provide points of attachment for terminals and the external wire bracing. Ailerons and flaps are carried on ball bearing hinges, cantilevered out behind the rear spar at the drag strut station. Details may be seen in an accompanying picture.

The wing flaps are of the split variety hinged like the ailerons, from brackets carried on the rear spar. They are hydraulically operated from the same double acting pump in the cockpit that handles the landing gear. They are pumped down, and will hold their position at any angle from 0 to 60 deg. When released, by operating the proper selector valve on the instrument board, they return to the "up" position automatically under the combined action of springs and air pressure.

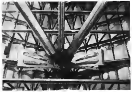
Of considerable interest is the design of the fuel tanks, one located in each wing panel. As the wing is thin, the tanks must be very flat. They are made principally of corrugated sheet, with the corrugations running spanwise of the wing. End plates of the tank are made by drawing scalloped edges which match up with the sheet corrugations. Final assembly is made by shot welding. These tanks are remarkably rigid and have stood up under the standard Army vibration tests. They weigh only 14.5 lb. each, including fittings for a capacity of 26 gal. each, a rather remarkable achievement.

[Note: Many of the ideas discussed by W. A. Sutton in his articles on stainless steel design—AVIATION, June and July, 1935—appear in the details of the Sea Bird.]

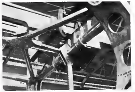
The power plant is a 285 hp. Jacobs engine attached to the mount through Lord rubber bushings of the shear type. Oil tanks and the storage batteries supplying power for the direct cranking starter are located in the nacelle. A Curtiss-Reed one-piece forged aluminum propeller is fitted.

Access to the four-passenger cabin is through a hatch in the center section of the wing to port, and slightly aft of the nacelle. Convenient steps and retractable hand holds are provided. A full complement of navigational and engine control instruments have been installed. Among the latter was noted the new Eclipse rate-of-flow meter. Dual control, with a wheel of the throw-over type, is installed. The cabin was unusually quiet before any upholstery or soundproofing material was applied. Sperry engineers did a soundproofing job that put the final sound level below 75 decibels.

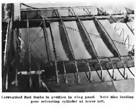
The weight of the ship empty is 2,285 lb., gross 3,415 lb. The useful load (1,130 lb.) is made up of four passengers, 100 lb. of baggage, 52 gal. of gasoline and 5 gal. of oil. With 235 sq.ft. of wing area (including ailerons) the power loading comes to 12.0 lb. per horsepower, wing loading 14.5 lb. per sq.ft. The ship has a top of over 150 m.p.h., cruises at 135 m.p.h. It shows a 900-ft. per minute rate of climb at sea level, has a 15,000-ft. service ceiling and a normal range of 450 miles.



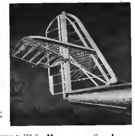
Tube cluster in center of rear cabin bulkhead. The triangular fittings are terminals for the flying wires



Details of fittings in upper rear cabin section. These members take the rear spar and rear nacelle strut loads



Corrugated fuel tanks in position in wing panel. Note also landing gear retracting cylinder at lower left.



Details of tail surface framing. Rudder tab is adjustable on ground only but elevators carry trimming tabs adjustable from cockpit.

Monocoupe Seaplane

Lambert Model 90-A approved for float equipment.

FLIGHT TESTED by a Bureau of Air Commerce Inspector, the Lambert Monocoupe, Model 90-A was recently granted an approved type certificate as a seaplane on Edo Model 1965 floats. In the flight tests conducted at the Edo plant in College Point, L. I., the ship made full load take-offs on glassy water in about 30 seconds. The floats specified for this ship embody design features formerly found only in the larger models and are exceedingly clean due to a new type of rounded nose.

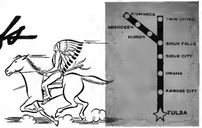
Weight of the Monocoupe Seaplane empty (including battery and starter) is 1,209 lb. Useful load is 562 lb., and gross weight, 1,771 lb.

Lambert Monocoupe Model 90-A on Edo floats

(Turn to page 44 for more Flying Equipment)

Trails of the Indian Chiefs

The Osage Chief, one of Hanford's fleet of all-metal twin-motored Lockheed Electras, equipped with every modern convenience for the passengers' comfort and safety.



HANFORD AIRLINES

gives a great country a great service

OVER the territories of the Sioux, White Cloud, Omaha, and Osage tribes, Hanford Airlines is providing the Middle West with a De Luxe Air Service that ranks with the finest in the country. Hanford Officials chose Texaco Aviation Gasoline, Texaco Airplane Oil, and Texaco Greases to fuel and lubricate their planes.

These products are refined from special crudes by special refining processes that eliminate all harmful impurities. They are free from harmful carbon and sludge forming elements . . . and are absolutely uniform.

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A Texaco aviation representative will be glad to provide practical engineering service to prove the economies of Texaco Aviation Products.

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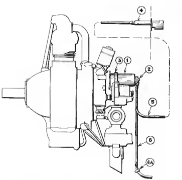


Installation diagram of Coffman starters. (1) Starter; (2) burning chamber; (3) clamp rings, (4) breech (5) intake tube (6) exhaust tube; (6a) clamp.

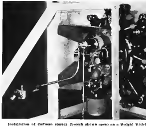
Cartridge Starter

Device provides engine starting from special powder cartridges.

A DEVICE known as the Coffman engine starter has been under development for a number of years by Federal Laboratories, Inc. (185 - 41st Street, Pittsburgh, Pa.) and is now ready for commercial production Coffman starters have been under test with Army, Navy and Marine Corps units and have proven their ability to start engines of the Cyclone or Hornet class satisfactorily at operating temperatures down to —20 deg. F. They are adaptable also to any type of internal combustion engine besides aircraft engines

Power to operate the starter is derived from a cartridge which contains a fuel which is ignited by the passage of an electric current The cartridge is placed into a chamber which resembles an ordinary shotgun breech, mounted in the cockpit near the pilot A tube connects the power chamber with the starter. The only electrical energy required is from a flashlight battery As the fuel burns in the cartridge it develops a pressure which moves the piston forward in the starter, engaging the clutch jaw of the cranking shaft and then rotating the crankshaft

Two sizes are available, the large size which develops 2,150 torque pounds at the shaft and the smaller size which will develop 1,250 torque pounds at the shaft. These starters will turn the engines at an initial rate of 225 to 250 r.p.m, sufficient to pick up the magneto spark at 30 deg before top dead center. The time of application is not long, although the rate is high The large starter (Type L) will turn over an average Cyclone engine three times at freezing temperatures, but this is usually sufficient to start. The assembly and the component parts are shown on an accompanying diagram The Type M starter weighs 25 lb, the Type L 35 lb The Type M will take care of engines up to 450 hp and the Type L from 450 hp up Standard cartridges weigh 063 lb and 079 lb respectively



Installation of Coffman starter (breech shown open) on a Wright Whirlwind on a test stand.

Seversky Trainer

New XBT is improved version of earlier models

LOW BIDDER in the latest competition for Air Corps Basic Trainers was the Seversky Aircraft Corporation whose offering was a refined version of the earlier Basic Trainer described in detail in the June, 1936 issue of AVIATION. Essential differences between the new XBT and its predecessor are greater speed range, higher performance, and improved instrument equipment

Both cockpits are fitted with instruments necessary for cross-country navigation, radio flying, instrument flying and reconnaissance Hoods for blind flying also are provided for both A camera machine gun for simulated combat is another part of the equipment

Performance of the new trainer approaches that of modern pursuit planes A throttle stop is provided to step down the output of the 550 hp Pratt & Whitney Wasp engine to 450 hp, Air Corps limit for training plane specifications. In an emergency, however, it would be possible to use the full rated power of the engine, materially increasing performance.

Two sets of wing panels of different areas are available With the larger ones and a fixed landing gear the ship is primarily a trainer. With the smaller panels and a fixed landing gear the ship becomes an improved edition of the Basic Trainer With smaller panels and retractable gear the maximum performance is attained for use as an advanced trainer, cross-country, and staff plane and pursuit performance is approached closely.

Structural characteristics are similar to those of earlier Seversky models and include monocoque fuselage and multi-spar wings built liquid tight to be used as fuel tanks

Seversky XBT en route for Wright Field design competition.

Frank Hawks' Plane

Fast low wing monoplane now undergoing test flights

REPORTS have been filtering in from Springfield, Mass, that Frank Hawks has been at work on the design and development of a new ship and that Howell Miller, formerly of Granville, Miller & DeLackner, has been collaborating. We are able to present the preliminary details here for the first time

The new Hawks plane (christened "Time Flies") and sponsored by the Gruen Watch Company, has been test flown at the factory of Hawks Aircraft, at Springfield, and promises speeds well up in the 300 400 mile range. Its power plant is a Twin Wasp R-1830 B G, equipped with a Hamilton-Standard Constant Speed propeller

"Time Flies" is a low wing cantilever monoplane with retractable landing gear, flaps, and tabs Most unusual feature is a retractable cabin enclosure In retracted position the enclosure fairs perfectly into the fuselage lines and vision is obtained through side windows and upper window lights of curved safety glass For landing and take off the seat may be raised by a manually operated hydraulic jack The top window light, which is hinged at its forward edge, raises with the seat and forms a conventional windshield Entrance is through a side door in the fuselage

The fuselage is constructed of welded steel tubing with plywood covering and the fin structure is of steel tubing with plywood ribs. Stabilizer, rudder, and elevators have spruce spars, maple corner blocks, and plywood ribs, and plywood covering. The wing is built entirely of wood, having three plywood box spars, and ribs and covering of the same material.

A range of 1,700 miles is obtained from the 230 gal gasoline tank forward of the cockpit. Oil capacity is 25 gal The wing span is 31 ft., and overall length 22 ft

The Curtiss-Wright P-36 Pursuit.

Curtiss-Wright P-36

Army buys new single seat pursuit monoplanes

CURTISS-WRIGHT has just announced that several of its P-36 pursuit planes have been purchased by the Army Air Corps The P-36 is a single seat low wing monoplane with retractable landing gear. It is powered by the Wright G Cyclone engine. The top speed, said to be high, is held confidential by the Air Corps

Stearman Model 76 D1 advance trainer

Stearman Trainer

Model 76 D1 is also suitable for other military missions

A FLEET of Stearman Model 76 D1 advanced trainers were delivered recently to the Argentine Naval Aviation Service. In addition to training work these ships are suitable also for reconnaissance, observation and light bombing The power plant is a 320 hp. Pratt & Whitney Wasp Jr, Model T1B.

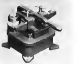
Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Electric Brazer

Compact unit for reconditioning band saw blades

SHOPS using band saws for cutting wood or metal sometimes encounter frequent breakages A compact electric brazer has been developed for repairing blades by Grob Bros, of West Allis, Wis The brazer is made for either 110 or 220 volts, single-phase, 60-cycle alternating current. A transformer is mounted in the base with extensions through the top cover connecting the secondary coil with the saw clamps The



Grob Bros electric brazer.

center clamp, intended for pressing the blade ends together during brazing, is operated with a handle A switch mounted in convenient reach of the operator provides three different heats. Silver solder with borax flux is recommended for the best joints The outfit weighs 50 lb

Drafting Machine

A new item of equipment for the engineering department

NEW models of drafting machines have been announced by the Charles Bruning Co, Inc, Chicago, Ill These machines

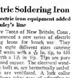
New Bruning drafting machine

feature reduced number of working parts and a simplified system of adjustment They are equipped with adjustable brake mechanisms to prevent the protractor head from sliding excessively when used on an inclined board. Each also has adjustable skid buttons for leveling up the scales. Pulleys are fully enclosed, but bands may be changed if necessary without disassembling the machine. The joints are fitted with New Departure fully enclosed ball bearings, prelubricated. All parts are of dull-finish aluminum or baked on enamel, eliminating reflections which cause eye strain Several models are available designed for specific engineering purposes

Metal Cutting Machine

Semi-automatic device designed for cutting light-weight metal sections

A SEMI-AUTOMATIC metal cutting machine for light section material is announced by De Walt Products Corp, Lancaster, Pa This equipment is specially adaptable for cutting lengths of thin wall tubing of aircraft sizes It is arranged for automatically cutting predetermined lengths of stock to close tolerances. For example, the machine illustrated will cut off light wall tubing 2 in in diameter and 6 in long at the rate of 28 cuts per minute This par-



De Walt light tube cutting machine

ticular outfit is equipped with a $7\frac{1}{2}$ hp motor driving a 16 in hollow ground metal cutting saw blade at 3 600 r p m Machines can be built on the same principle for many applications Completely automatic equipment including a device for feeding material from a magazine onto the extension support is also available

Particular attention has been given to enclosing and guarding the machine The top of the frame is covered to keep chips and grit from the working parts and provision has been made to confine the sparks in a hood Three control stations are provided, one at each side of the machine and the third at the front of the material support Each station controls both the feed and saw motors so that a dead saw cannot be fed into the material Full details are available to our readers upon application to the manufacturer.

Low Pressure Wheels

New models interchangeable with high-pressure types

AIR TRANSPORT EQUIPMENT, INC (Building 20-A, Roosevelt Field, Garden City, L. I, N Y) now has available two models of low pressure wheels designed to replace high pressure wheels of the Bendix type One is for the $1\frac{11}{16}$ in axle, 10 in drum, and takes either the 6.50-10 the 7 50-10 or the 8 50-10 tire The larger model is for $2\frac{3}{16}$ in axle with 12 in drum, and takes 9 50-12 tires No changes or adapters are required when installing these wheels on present Bendix brake mechanisms Graphited, oilless bearings are fitted to both models Both wheels are manufactured under Department of Commerce A.T.C. The smaller size is approved for airplanes up to 3 200 lb gross, the larger up to 5,000 lb gross weight

Electric Soldering Iron

New electric iron equipment added to Stanley's line

STANLEY TOOLS of New Britain, Conn, has announced a new series of electric soldering irons for bench use They come in eight different sizes ranging from 52 watts with a $\frac{7}{16}$ in. tip, to 435 watts with a $1\frac{3}{16}$ in tip Tips are pure compressed copper The electrical windings are built in, are hermetically sealed Handles are ventilated. A lock collar and a sleeve takes care of adjusting to the desired length Handles are also removable A metal resting stand is packed with each iron Six feet of flexible heating cord with terminal are furnished as regular equipment with each tool.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 10 How do you compute operating costs of the various types of aircraft used by flying school operators? What cost factors do you use? On what basis do you compute depreciation of equipment? (Submitted by Edward A Dycer Manager Dycer Flying Service Los Angeles, Cal)

(Sometime ago we received an unusually complete reply to Question No 10 The reply was so complete in fact, that we were unable to find space for it in a number of issues The methods of operation cost computation, however, were so interesting, that we decided to publish them at the first opportunity They are presented herewith —Ed.)

Experience in cost computing

OUR own methods of computing the cost of operating our airplanes as based upon experience are as follows: We include a separate sheet for each of the airplanes we operate made up according to the method we have been using, and we also include a single sheet descriptive of another method we intend to put into operation later

On the sheet describing the Ryan S-T, in addition to a fuel cost of $1 333 per flying-hour, and a maintenance cost of 80 cents per flying-hour (which in the past has proven to amount to approximately 60 per cent of the fuel cost), we have a cost of $1 476 per flying-hour for risk and $1 766 depreciation Maintenance incidentally includes overhauls, repairs, inspection, parts, labor and hangar storage.

Risk or insurance is figured at 18 per cent of the value of the ship per year Naturally, this cost is $1 476 only when the ship is flown 500 hours in one year The maintenance cost of 80 cents will also vary with the number of hours flown per year

Depreciation is figured on the engine separate from the ship, with the full retail value of the engine being written off in 1,500 hours and that of the ship in 3,000 hours The depreciation is not figured in terms of months or years, nor does it indicate the actual life of the engine or ship, but is merely a method of returning to the owning interest the full investment in a reasonable time

The total cost of operating this particular ship amounts to $5 375 per flying-hour when the ship is flown 500 hours in one year At the end of the year, we make up a new cost estimate for operation during the following year based upon the actual results of the first year Maintenance may show an increase during the last six months Risk may have also jumped up during the year due to accidents not covered in the "10 per cent deductible" Depreciation will, of course, be reduced for the second year provided the airplane is revaluated at the end of the first year

We might mention that the great majority of small airplanes are not flown as many hours per year as ours A private owner, for example, would probably fly a Ryan S-T about 100 hours per year, which would multiply his insurance cost from $1 476 to $7 38 per hour, which would indicate that present insurance rates are prohibitive for the private owner as well as the small operator doing less than 500 hours per year However, any operator who is able to put 1,000 hours per year on an airplane should buy insurance

We are now equipped with five airplanes and are carrying insurance on three of them Unfortunately one of the three is not flying enough this year to warrant the purchase of insurance next year. We will buy insurance only on those airplanes doing in excess of 50 hours per month

Regarding the other costs to the operator, it has been our practice to subtract the ship cost (which in this case is $5 375) from the retail price to ascertain the gross profit per flying hour Two-thirds of this gross profit goes to the cost of general overhead The remaining one-third is divided equally between the "owning interest"

Operating Costs for Five Airplanes

Ship Operating Cost	Ryan S-T	Great Lakes	Rearwin Sportster	Rearwin, Jr.	J 5 Stearman
Fuel	1 332	1 377	1 127	822	3 620
Maintenance	(60% F) .800	(70% F) .964	(60% F) .676	.490	1 086
Risk	(18 per cent—500 hr) 1.476	(22½ per cent—500 hr) .563	(18 per cent—1,200 hr) .377	(22½ per cent—1000 hr) .146	(15 per cent—1,000 hr) .252
Depreciation	1 766	.550	.926	.300	.634
Profit to owning interest (20 per cent)	5 375 1 075	3 445 .689	3 104 .620	1 761 .352	5 592 1 118
Cost to operator	6 450	4 134	3 724	2 113	6 710
Operator's overhead (80 per cent)	5 160	3 307	2 979	1 690	5 368
	11 610	7 441	6 703	3 803	12 078
Operator's profit (10 per cent)	1 161	744	670	380	1 207
Retail price	12 771	8 185	7 364	4 183	13 285

Costs per flying-hour

Operating cost of Ryan S-T, Menasco 95 hp. Cruising speed—120 m.p.h. Top speed 140 m.p.h.

1. Fuel:
   - Gas (70 per cent bhp Consumption) 5.535 gal @ .20 ..... 1.107
   - Oil (100 per cent bhp Consumption) .075 gal @ 1.40 ..... .105
   - Grease (Estimated) ..... .05
   - 1.333
2. Maintenance (Est. 60 per cent of Fuel) ..... .800
3. Risk (18 per cent of $4 100.00—500 hr) 1.476
4. Depreciation
   - (Engine value—$3 200.00—1,500 hr) ..... .800
   - (Ship value — $2 900.00 — 3,000 hr) ..... .966
   - 1.766

Total ship operating cost 5.375
Plus profit to owning interest 1.075

Cost to operating agency 6.450
Operator's overhead (Advertising, salaries, pilot salaries, rental etc) 5.160

11.610
Profit to operator 1.161

Retail price $12.771

Operating Cost of J 5 Stearman, 220 hp. Cruising Speed

1. Fuel 3.620
2. Maintenance (Est 30 per cent of Fuel) 1.086
3. Risk (15%—$4,600.00—1 000 hr) ..... .252
4. Depreciation (Engine & Ship) ..... .634

Total Ship Operating Cost Plus Profit to Owning Interest 5.592
1.118

Cost to Operating Agency Operator's Overhead (Advertising, salaries, pilot salaries, rental, etc) 6.710
5.368

12.078
Profit to Operator 1.207

Retail Price $13.285

Operating Cost of Great Lakes Cirrus 95 hp Cruising Speed—84 m.p.h., Top Speed—103 m.p.h.

1. Fuel
   - Gas (70 per cent bhp Consumption) 6.03 gal @ .20 ..... 1.206
   - Oil (100 per cent bhp Consumption) .09 gal @ 1.40 ..... .126
   - Grease (Estimated) ..... .040
   - 1.372
2. Maintenance (Est. 70 per cent of fuel) ..... .960
3. Risk (22½ per cent of $1,250.00—500 hr) ..... .563
4. Depreciation
   - (Engine value $400.00—1,500 hr) ..... .266
   - (Ship value $850.00—3,000 hr) ..... .284
   - .550

Total Ship Operating Cost Plus Profit to Owning Interest 3.445
.689

Cost to Operating Agency Operator's Overhead (Advertising, salaries, pilot salaries, rental, etc) 4.134
3.307

7.441
Profit to Operator ..... .744

Retail Price 8.185

and the "operating agency." The owning interest and the operating agency may or may not be the same entity In other words, the airplane may be operated by our company but owned by an individual The books, however, are kept in the same manner for ships owned and operated by us

We realize of course that it is poor business to set a retail price before ascertaining the cost of overhead and profit to owner and operator But as prices have been controlled by an organization of all operators in Seattle, we have had no other choice However, I hope to present figures in the near future to the members of our organization which will enable us not only to establish retail prices in a more intelligent way but will also adequately answer the question of insurance cost

The plan I have in mind is illustrated by the single sheet enclosed on which all five airplanes are listed If you will examine this sheet you will note that 20 per cent of the ship's operating cost will be paid to the owning interest

In the event an operator is able to keep his overhead below this 80 per cent he would be able to earn a net profit of more than 10 per cent It is not our plan to attempt an increase in the net profit in this manner We would prefer to spend the entire 80 per cent by an increase in advertising, sales commissions and salaries, in the belief that a greater volume will be thus attained

You will note that the risk has been computed on three airplanes at 18 per cent and on two of the airplanes at 21½ per cent This is because of the type of flying they do You will also note that two of these airplanes are estimated to fly 500 hours per year, one 1,200 hours and the remaining two, 1,000 hours each

You may also notice that maintenance is figured at from 30 per cent of the fuel cost on the Stearman to 70 per cent on the Great Lakes. Because maintenance cannot always be based upon past experience for a given airplane we use the following schedule for a predetermined estimate:

New Airplane	33 per cent
3 months old	40 per cent
6 " "	50 per cent
9 " "	60 per cent
12 " "	70 per cent
15 " "	80 per cent
18 " "	90 per cent
21 " "	100 per cent
24 " "	110 per cent
27 " "	120 per cent
30 " "	130 per cent
33 " "	140 per cent
36 " "	150 per cent

Immediately after an engine major or a complete ship overhaul and recover, the estimate may be dropped back 10 per cent.—LEONARD R. PETERSON, *President, Leonard R. Peterson, Inc., Boeing Field, Seattle, Wash*

Editor's Note—Questions 18 and 19 appeared in the September issue of Aviation.

Tomorrow's Clippers

(Continued from page 17)

Table IV
Resistance and Power Required to Overcome the Parasite Drag of Different Flying Boat Hulls per 1000 cu.ft. of Pay Space at 160 m.p.h. at Sea Level

Plane Type	Gross Weight in Tons	Frontal Area	Drag in Lb at 160 mph	bhp Req'd	Cubic Cap of Pay Space	Cap in 1000 cu ft	Drag per 1000 cu ft	bhp Req'd 1000 cu.ft.
S 20	2	28	258	110	200	.2	1290	550
S-43	10	81	550	235	1280	1 28	430	184
S-45	33	220	1410	603	7400	7.4	191	81 8

(2) If the design factors are properly taken into consideration, it is possible to gain more from improved parasite resistance than is lost from greater structural weight of certain parts of the structure and the larger ship will be the more efficient one.

(3) With respect to the flying boat, several important characteristics improve as the size increases The larger boat has (under identical conditions) better take-off because the hump speed occurs later and therefore when the wings are carrying a greater part of the load The c.g becomes proportionately lower and the problem of lateral stability becomes simpler In view of these considerations, as well as several others, it appears probable that the optimum size of flying boats will in the near future be substantially in excess of the present day craft.

Some specific problems

While there appear important advantages directly connected with the larger size aircraft, there are also numerous engineering problems and difficulties yet to be solved

In a craft of 40 to 50 ton or more, the manual power of the pilot may be inadequate to operate the flying controls It may, therefore, be necessary to use some type of booster or power for all controls Auxiliary sources of electric and pneumatic power will be needed [Auxiliary power plants to produce 110 volt a c driven by small gasoline engines independent of the plane's engines, are now commercially available.—Ed] Ventilation and heating will become a large engineering problem, as well as the safe loading and distribution of 5000 to 7000 gallons of fuel

The basic aerodynamics and structure of a large airliner will embrace, of course, many important problems that will require considerable research and investigation The one generality that can be mentioned is that in both of these lines of thought it is necessary to study and design a large plane in general and in detail rather than to proportionately increase the size of a smaller plane

With respect to power plant, the simplest and most satisfactory arrangement for some time to come appears to be the installation of four to six independent engines, each driving its own propeller Various schemes have been studied with groups of several motors driving one large propeller with gears, shaft and clutches The advantages of the possibility of stopping an engine for inspection or disengaging it in case of trouble are evident with this arrangement, but it is questionable whether the advantages will be sufficient to compensate for the extra weight, cost and added sources of possible mechanical failure With respect to other types of engines, the large diesel may be developed, but at this time is not yet available. The steam power plant is still further away and it remains to be proven if some of the difficulties connected with such an installation (particularly the enormous steam condensers) can be properly solved On the other hand, the conventional internal combustion aviation engine is available in necessary sizes, is thoroughly developed and tested and most certainly represents a satisfactory power plant for years to come.

The extreme importance of maximum power per unit of fuel may eventually bring the use of some auxiliary means to utilize the heat from exhaust gases This may be in the form of a small steam power unit with a group of boilers heated by exhaust gases The power generated may be geared back to the propellers or may be used for driving electrical generators or other mechanisms The amount of power received from this source, however, would represent only a small fraction of the total power of the plane, and the condensing of steam would not present great difficulties Besides, exhaust steam could be utilized for deicing, heating the plane, heating water in the washrooms, etc

A certain experience with aircraft design similar to the one under discussion permits the full realization of the considerable amount of important engineering problems connected with the development of an oceanic airliner

Many of the problems are serious and their correct solutions are often substantially different from what would appear correct for aircraft of conventional size and range But the problem can be solved on the basis of modern technique and experience There is every reason to believe that present trends in the development of trans-oceanic equipment will shortly result in the establishment of scheduled air service to Europe on a 20 hour flying time basis by luxurious air transports

News of the Month

Highlighting recent events in the aviation world.

★ ***World Transport*** **. . . Germany's Lufthansa sends over two flying boats to test Atlantic flying conditions.**

★ ***Domestic Transport*** **. . . American inaugurates sleeper service Sept. 18 with Douglas DST's . . . Phenomenal traffic gains for Central, which is considering merger with Pennsylvania . . . Transpacific passenger service announced by Pan American to start Oct. 21; the Bureau of Air Commerce sets inauguration of service within "30 to 60 days" . . . Half an hour to more than an hour cut from TWA schedules . . . United Air Lines orders 27,000,000 gal. of fuel for next three years.**

★ ***Races & Records*** **. . . A table giving complete race results.**

★ ***Transatlantic*** **. . . Dick Merrill and Harry Richman make a record round-trip crossing . . . Mrs. Beryl Markham is first woman to solo east to west.**

★ ***Army & Navy*** **. . . Bids on observation planes opened at Wright Field . . . Navy to launch new Aircraft Carrier Enterprise.**

★ ***Bureau*** **. . . Report on the TWA Sun Racer accident near Uniontown, Pa.**

★ ***Industrial*** **. . . Commerce Department reports rising exports . . . Year's first half aircraft production totals 1,363, compared with 851 for first half of 1935 . . . Taylor production continues large . . . New hammer shop at Boeing . . . Stearman-Hammond setting up shop . . . Bendix to build $1,000,000 west coast plant.**

★ ***Financial*** **. . . Profits for Lockheed, Irving Air Chute in first half.**

Transatlantic

A flurry of ocean crossings brings two German survey planes, a round trip, and a feminine solo

ALTHOUGH international commissions from Great Britain, Germany, and France, in conference with the President's Interdepartmental Committee on Civil International Aviation, had smoothed away political and diplomatic difficulties barring Transatlantic heavier-than-air service as long ago as last winter, no other visible action toward the start of the service was taken until early in September. The United States had been ready for some time with equipment suitable for survey purposes at least, but lacked landing privileges on British soil. Great Britain held the upper hand in regard to landing facilities, but until recently had no suitable equipment. In July Britain began flight tests on the first of her so-called "Empire type" flying boats. Thus Pan American Airways, to keep within its cooperative agreement with Britain's Imperial Airways, had perforce to wait for British technical developments.

Then Germany, after several years' intensive development of a South Atlantic service, suddenly began experimenting in the North Atlantic. Her principal problem was securing landing facilities. Early in May the Deutsche Zeppelin Reederei began a series of ten round trips between Frankfort and the Naval Air Station at Lakehurst, N. J., with the Zeppelin Hindenburg.

Last month the Germans again stole a march on the world. From Horta in the Azores the Deutsche Lufthansa launched two Dornier DO 18 flying boats. Landing arrangements had been made with Pan American Airways for the use of its provisional marine terminal at Port Washington, N. Y., where a radio station had been set up some months ago. Capt. Rudolph Jahn will direct Lufthansa's activities in the United States.

The Aeolus, first of the two German boats, turned back when nearly a third of the way to Bermuda, due to trouble with the cooling system. The Zephir, the second boat, was launched from the mothership Schwabenland Sept. 9, flew the 2,390 miles to Port Washington non-stop in about 22 hours.

The Aeolus was again launched on the tenth and headed for Bermuda, 2,063 miles away. The second attempt was successful, and after resting over night in Bermuda, she completed the trip to New York, 770 miles, in 6 hours, 18 minutes.

Both ships were scheduled to return to the Azores late in September. The Schwabenland steamed to New York from the Azores to launch them back again. The flights were the first of a series to determine flying conditions, suitability of equipment, navigation, and landing facilities. With the exception of extreme cold and snow the Zephir non-stop flight encountered nearly every kind of Atlantic weather with clouds and bad head winds for almost half the distance. The Aeolus had a better break. Her captain, H. W. Engel, said that he had flown most of the way from Bermuda very close to the water, where flying qualities of the Dornier are best. It also enabled the crew to take advantage of a sea training in navigation as far as ability to determine wind direction and drift were concerned.

Launching by catapult from a mother

FLIGHT CREWS

Which brought the Zephir and the Aeolus from the Azores to Port Washington: (l. to r.) First Pilot R. W. von Engel, Radioman H. J. Stein, Second Pilot Baron A. W. von Buddenbrock, Mechanic Otto Groshwitz of the Aeolus, and Second Pilot Karl von Gablenz, First Pilot Joachim Blankenburg, Mechanic A. Eger, and Radioman Willy Ehlberg, of the Zephir.

Acme

DIESEL DORNIER DO.18

used by Lufthansa in its experimental North Atlantic flight from the Azores to Port Washington.

ship is a German practice which has been followed since early 1934 on the regular weekly schedule across the South Atlantic from Bathurst in Africa to Natal in Brazil. Over 200 crossings have been made, piling up a total of 400,000 miles

Americans had their first opportunity to witness Lufthansa's catapult operations at a demonstration staged in Long Island Sound off City Island September 22 The Zephir was launched from the Schwabenland for a short test flight which terminated at the PAA Port Washington base Later the same day the Aeolus left the catapult and headed for the Azores, followed next day by Zephir Lufthansa's guests saw the launchings from the mother-ship's deck

The present experimental planes are monoplane flying boats powered with two Junkers Jumo 205 diesel engines delivering 500 hp each, They are mounted in tandem above the wing The boats are equipped with radio utilizing both long and short wave transmission, and in addition have a directional loop antenna homing device. The ships carry a crew of four: two pilots, a radio operator and a mechanic.

Three other North Atlantic crossings figured in the month's news On Sept 2, Harry Richman, New York night club singer, and Henry T (Dick) Merrill, one of Eastern Air Line's senior pilots, left Floyd Bennett Field, Brooklyn, N Y., and set a course for London. They intended to make a record round-trip flight. Their plane, "Lady Peace," was a Vultee, powered with a 1,000-hp Wright G-Cyclone It carried 1,000 gal of fuel—"a flying gas tank," as Richman described it—theoretically sufficient for from 20 to 22 hours. This should have given the fliers a margin of about 600 miles.

The trip proved to be foggy, however, and the fliers failed to see their first landmark, Ireland They circled for about an hour and a half to get their bearings Finally they came down in Wales, 175 miles short of their goal, after a flight of 18 hours and 8 minutes They landed undamaged in a cow pasture, and next day completed their journey to London

Sept. 13 they left Southport, England, for the return journey, and again came down short of their goal, landing in a bog at Musgrave Harbor, (Nfld.) about 100 miles north of Harbor Grace They were 1,200 miles from New York, but had flown the 2,300 miles from England in 17 hours 24 minutes. They reported no damage except a bent propeller

Eddie Rickenbacker, general manager of Eastern Air Lines, immediately set out on a rescue expedition in one of Eastern Air's DC 2s From Harbor Grace, he continued north in a motor launch, arrived to find the "Lady Peace" out of the bog and ready to continue A few days later a successful takeoff was accomplished and the ship was flown back to her starting place at New York's Floyd Bennett Field

The fifth North Atlantic crossing, from east to west, was made by blonde, athletic Mrs Beryl Markham, British sportswoman pilot She flew a Percival Vega Gull from Abingdon Air Field, Berkshire, England to the coal mining village of Baleine, 18 miles from Louisburg, Nova Scotia, where she plunked the nose of her ship three feet in the mud

Her goal was Floyd Bennett Field, in Brooklyn, but she ran out of gas in a 23 hour flight with adverse winds She left England with no radio, despite the knowledge that she would have to fight not only prevailing west winds but rains and fog as well Her plane received a damaged propeller and undercarriage, but Mrs Markham's injury was nothing worse than a cut forehead She was the first woman to make the solo westward crossing

Army and Navy

Bids on Air Corps observation planes; new carrier for the Navy

THE ARMY news-month centered on Wright Field, Dayton, where bids were opened September 4 on observation planes in quantities ranging in increments of five from ten to 125 Low bidder was the Douglas Aircraft Company which bid $22,420 each on ten and $18,022 each on 125 The same model with de-icer equipment was priced at $24,800 to $18,600 The only other bidder, North American Aviation Corporation, bid $42,900 each for ten and $28,490 each for 125

On Oct 3, Mrs Claude A Swanson, wife of the Secretary of the Navy, will crack the traditional bottle of champagne over the bow of the U S S Enterprise, the Navy's newest aircraft carrier, at Newport News, Va. The carrier is of 20 000 tons displacement and is the sister ship of the U S S Yorktown, launched last April.

Accident Report

Department of Commerce findings on TWA crash at Uniontown

IN A REPORT on the accident last April 7 of the TWA Sun Racer near Uniontown, Pa , the Bureau of Air Commerce ascribed the probable immediate cause of the accident to "poor judgment on the part of Pilot Ferguson for flying by visual ground observation methods after having descended through clouds and overcast in mountainous terrain at a point unknown to him " Ferguson was flying the regular Sun Racer schedule from New York to Pittsburgh, via Camden with eleven passengers According to the Bureau's reconstruction of events leading up to the accident, he was flying "at a point unknown to him" because of his "failure . . . to proceed to and follow the right-hand side of the west leg of the Harrisburg radio range course when it first became necessary for him to resort to instrument flying in the vicinity of Harrisburg due to weather conditions and failure to complete his flight on the right-hand side of the northeast leg of the Pittsburgh radio range, as provided for by both the Department of Commerce and TWA regulations."

The flight plan prepared by Ferguson at Newark called for a direct compass course from Camden to Pittsburgh in the event the weather was suitable for contact flying Instead, according to the report, he flew on what he thought was a compass course but which was actually a course deflected considerably to to the south

Wide World

FIRST PICTURE
of Douglas' newest creation, a 32-passenger 28 500-lb flying boat. It is expected to cruise 1 800 miles on the power of two 1 000 hp Wright G Cyclones Span is 88 ft., length 70 ft

Transcontinental, Transpacific

Sleeper service on American; PAA announces transpacific service; schedule cuts on TWA

Long awaited transcontinental sleeper service was scheduled to start on American Air Lines Sept 18, with Douglas DST Flagships making the eastbound run in 15 hours, 50 minutes Westbound the scheduled time is 17 hours, 41 minutes The "American Mercury" will leave Newark at 5 10 pm and Los Angeles at 4 30 pm Only stops will be at Memphis, Dallas and Tucson The "Southerner," to go in service Oct 1, will stop at Washington, Memphis, Fort Worth, El Paso and Phoenix Flagship service to Detroit and Buffalo will start about the middle of October.

Sept. 21 Pan American announced the long-awaited start of transpacific passenger service for Oct 21 One round trip a week will be made, using the line's three Martin flying boats Experimental flights have been made with the Martins since last November, resulting recently in a once-a-week schedule A flight over the line by Bureau of Air Commerce inspectors has just been completed Reported from the West Coast is the signing of an agreement between Pan American and the Dollar Steamship Company, whereby the Dollar Line will act as agent for PAA and will also maintain radio communication on flight schedules

Central Air Lines, operating between Washington and Detroit, continued its phenominal gains in passenger service in August, when a gain of 144 per cent over August of 1935 was reported The first eight months of this year showed revenue passengers totaling 12,190 against 2,953 for the same period last year.

Pennsylvania Air Lines and Central Air Lines, the former carrying mail over route 32, from Detroit to Milwaukee, and the latter with a mail contract for route 14 from Washington to Detroit, are reported to be considering a merger In addition to its Milwaukee-Detroit mail service, Pennsylvania has passenger service through to Washington

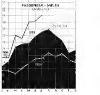
AUXILIARY ANTENNA
developed by TWA to supplement the regular system It weighs less than 5 lb, is shot from the tail cone by a compression spring

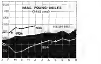
Starting Sept 15, Transcontinental & Western Air cut from half an hour to more than an hour from most of its schedules, according to an announcement by President Jack Frye The westbound Sky Chief schedule will be run in 16 hours 59 minutes, 35 minutes under the previous schedule It will leave New York at 5 15 pm and arrive in Los Angeles at 7 40 a.m Preparation for winter flying was started early in September at the company's maintenance base at Kansas City, where de-icing equipment is being reinstalled on all TWA skyliners The removal of the equipment early in the spring followed a winter of highly successful operation in controlling the formation of ice Units to be installed include rubber overshoes on the leading edges of wings and tail surfaces and the slinger ring propeller de-icer developed by TWA.

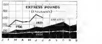
The largest fuel contract in the his-

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







tory of aviation was consummated early in September when United Air Lines ordered a three years' supply of gasoline, involving the delivery of a minimum of 27,000 000 gal The fuel was ordered from the Colonial Beacon Oil Company and other Stanavo distributors, and will be delivered at airports in 37 cities in fifteen States

Factories Expand

Total production up for first half; enlargements at Boeing

PRODUCTION REPORT from the Bureau of Air Commerce for the first half of 1936 shows a total of 1,363 aircraft produced, including 764 domestic civil aircraft, 407 for military use and 192 for export. This compares with a total of 851 produced in the first half of 1935, and is more than were produced in the full calendar year 1933

At the Taylor factory in Bradford, Pa, production continues at a rapid pace 67 Cubs were turned out in the 26 working days of August. This was down slightly from the 72 produced in July.

Work has been started on a $15,000 addition to the factory of North American Aviation, Inc, 5701 Imperial Highway, Los Angeles, Cal The addition will have two wings, 60x75 ft, and 20x 390 ft.

D E Anderson, chief engineer with the Bohn Aluminum & Brass Corporation, Detroit, and developer and originator of the V-8 type motor with Cadillac in 1912, has joined the Arrow Aircraft Corporation at Lincoln, Neb, as consulting engineer. Arrow is now in commercial production on the Arrow Ford V-8, powered with the Ford V-8 motor. It recently received its A.T.C.

Marking another step in the enlargement of plant facilities in the Boeing Aircraft Company, Seattle, Wash, a new 90x120 ft hammer shop was being constructed last month. The number of hammers will be increased from 3 to 11 Meanwhile construction of the new $250,000 assembly building was nearing completion It will accommodate nine of the Boeing 299 bombers and will have unobstructed floor area measuring 200x 300 ft.

Two buildings on property adjoining Mills Field, San Francisco, have been taken over by the Stearman-Hammond Aircraft Corporation and are being remodeled. $20,000 in new construction has been started to permit production of the Menasco-powered Hammond Y by December.

The Barkley-Grow Aircraft Corporation has purchased the assets of the Supreme Propeller Co, of Wichita, Kansas Equipment and personnel are being installed in the Barkley-Grow plant in Detroit.

Bendix Aviation Corporation, according to Vincent Bendix, will build a million dollar plant at Los Angeles 'We will . . . start production matching that of our other three principal plants at New York, South Bend and Chicago" he said

National Air Race Results

Municipal Airport, Los Angeles, Cal, Sept 4-8, 1936

Place	Plane	Engine	Pilot	M P H (Aver.)
QUALIFYING SPEED (FIVE MILE COURSE): 375 CU. IN.				
1	Folkerts	Menasco	Harold Neumann	230 061
2	Chester Special	Menasco	Arthur C. Chester	227 733
3	Miles & Atwood	Menasco	Lee Miles	223 158
4	Wittman	Menasco	S. J. Wittman	215 079
QUALIFYING SPEED (FIVE MILE COURSE): 550 CU. IN.				
1	Caudron	Renault	Michel Detroyat	273 473
2	Kling-Rider	Menasco	R. A. Kling	226 444
3	Elmendorf Special	Menasco	David Elmendorf	224 551
4	Howard DGA4	Menasco	Harold Neumann	223 714
5	Rider	Menasco	Roger Don Rae	215 153
6	Brown B2	Menasco	Marion McKeen	217 365
SHELL TROPHY RACE: 375 CU. IN.				
1	Folkerts	Menasco	Harold Neumann	223 201
2	Chester Special	Menasco	Arthur C Chester	222 235
3	Miles & Atwood	Menasco	Lee Miles	202 848
4	Howard	Wright Gipsy	Joe Jacobson	147 424
SHELL AWARD: 375 CU. IN.				
1	Folkerts	Menasco	Harold Neumann	231 344
2	Chester Special	Menasco	Arthur C Chester	230 479
3	Howard	Wright Gipsy	Joe Jacobson	147 565
LOUIS W. GREVE TROPHY RACE: 550 CU. IN.				
1	Caudron	Renault	Michel Detroyat	247 300
2	Folkerts	Menasco	Harold Neumann	225 858
3	Chester Special	Menasco	Arthur C Chester	224 982
4	Kling-Rider	Menasco	R. A. Kling	216 331
5	Howard DGA4	Menasco	Joe Jacobson	214 428
6	Rider Racer	Menasco	Roger Don Rae	212 325
7	Brown B2	Menasco	Marion McKeen	204 475
SHELL CUP RACE: 550 CU. IN.				
1	Rider Special	Menasco	Roger Don Rae	225 844
2	Folkerts	Menasco	S. J. Wittman	223 561
3	Brown B2	Menasco	Marion McKeen	218 808
4	Miles & Atwood	Menasco	Lee Miles	206 188
5	Elmendorf Special	Menasco	David Elmendorf	205 835
THOMPSON TROPHY RACE: UNLIMITED				
1	Caudron	Renault	Michel Detroyat	264 261
2	Rider	Wasp Jr.	Earl Ortman	248 042
3	Rider Racer	Menasco	Roger Don Rae	236 559
4	Folkerts	Menasco	Harold Neumann	233 074
5	Brown B2	Menasco	Marion McKeen	230 465
6	Crosby	Menasco	Harry Crosby	226 075
BENDIX TROPHY RACE—TRANSCONTINENTAL FREE-FOR-ALL				Elapsed time
1	Beechcraft	Wright	Louise Thaden	14 55 01
2	Lockheed	P&W Wasp	Laura Ingalls	15 39 38
3	Vultee	Wright	W. Gulick	16 45 25
4	Douglas	Wright	George Pomeroy	18 10 31
5	Lockheed	P&W Wasp	Amelia Earhart	18 34 53

Financial

Substantial half-year profits for Lockheed, Irving Air Chute

FOR THE FIRST six months of 1936 the Lockheed Aircraft Corporation reported a net profit of $40,213, after deduction for Federal income tax. Net sales amounted to $660,975, and operating profit was $69 691 Unfilled orders totalled $1,250,000 compared with an order back log of $525,000 a year ago.

A net profit of $120 694, or 60 cents a share, was reported by Irving Air Chute Company for the six months ending June 30 This compared with $170,276 for the first half of 1935

The half year report of the Aviation Corporation and subsidiaries showed a net loss after depreciation, federal income taxes and other charges, of $174,-270, against a $195,408 loss for the first half of 1935

Calendar

Oct. 15-16-17—National Aircraft Production Meeting of the S A E., Ambassador Hotel, Los Angeles

Oct 25—Paris Saigon Air Race.

Nov 13-29—Fifteenth International Aero Exhibition, Paris, France.

Jan 26-Feb. 6, 1937—Aircraft Show, New York.

Schools, Services, and Airports

A state-by-state tour of the flying fields

• ALABAMA—A report of the Alabama Aviation Commission shows a total of 44 fields available for use in the State as of Sept 1. WPA projects are in operation in seven cities, and there are eight projects immediately pending . . . The Birmingham Aero Club sponsored a series of three spot landing contests at Birmingham Municipal Airport late in August and early in September The committee in charge consisted of Dave Denney, chairman, Tom Dozier W K Hughes, Charles L. McDaniel, J C. Schwem, James Adair, and E. P Green, Jr According to Steadham Acker, manager of the field, a $242,000 WPA project was scheduled to start early in September . . . The Montgomery School of Aeronautics reports the sale of a Waco to Carl Wooten . . . The WPA is considering establishment of an airport at Jasper for which $50,000 has been appropriated

• ARKANSAS—Hot Springs is considering enlargement and other improvements at Chamber of Commerce Municipal Airport.

• CALIFORNIA—The Long Beach City Aviation Commission is taking action to acquire additional lands at the municipal airport If present plans mature, the field will be a mile square It is planned to install new runways. . . . A new runway, 3,000x150 ft has been completed at Mills Field, San Francisco It is the first unit of a triangle of paved runways Tamped rock shoulders increase the width another 150 ft. Also under construction is a new $141,000 administration building, which will be two stories high and will provide 47,000 sq ft of floor space . . . Establishment of a waterfront airport for the San Diego area is being considered by Chula Vista . . . Don Smith, manager of Sacramento Municipal Airport has reported the greatest increase in flying activities since the field was dedicated in 1930 Twenty-three commercial and private planes are regularly hangared at the field . . . WPA is planning extensive improvements, including oiling of the runways, at Monterey Airport . . . The San Francisco Utilities Commission has recommended to the Board of Supervisors the purchase of the seventh of ten parcels of land for the enlargement of Mills Field The cost is set at $105,000 . . . TWA is considering extensive improvements at Needles Airport. Included in the plans are a water supply, beacon, field lighting and an administration building A teletype circuit is also being considered . . . Santa Rosa was planning dedication of its rebuilt municipal airport in September . . . According to a report by Glenn Smelser, manager of Clover Field, the Santa Monica Municipal Airport, so many planes are based at the field that every hangar is full . . . The WPA was scheduled to start resurfacing Santa Rosa Municipal Airport runways with red shale early in August. 40,000 cu ft of fill has already been put into the runway The main runway, running northeast-southwest, is 3,000 ft long and 300 ft wide There are two supplementary runways, 2,100 and 1,400 ft long and each 250 ft wide. The total cost of the project will be $63,856, of which $49,516 is being supplied by the WPA

PLOSSER STUDENTS
Discuss instrument flying at Joe Plosser's Grand Central Flying School Grand Central Air Terminal, Glendale Cal.

• CONNECTICUT—Owners of the Descomb and Aviation Service Hangars at Brainard Field, Hartford, will be required to pay only 50 per cent of the total amount of their leases covering the six months' period between May 15 and Nov 15, according to the Municipal Aviation Commission The adjustments were made to cover losses entailed when the field was flooded last spring. In addition, a full rebate will be allowed covering the period when hangars were unavailable for use. Construction of a series of runways and a new drainage system is scheduled to get under way early in September. . . . The Mollison Airport, Bridgeport, has been opened by the Stratford Meadows Corporation and leased to the Bridgeport Flying Club The field has been closed for some months, leaving Bridgeport without an airport. Aug 21 a committee of the Common Council met publicly to consider municipal purchase of the field, and 300 petitioners appeared, most of them urging municipal ownership The committee expected to have its report and recommendations ready by late September or early October James Malarkey has been named manager of the field, which is leased on a month-to-month basis, pending action by the City Council

• DELAWARE—Construction of a new 80x90 ft brick and steel hangar has begun at DuPont Airport, Wilmington.

• DISTRICT OF COLUMBIA—The Post Office Department has opened a new airmail building at Washington Airport. The Bureau of Air Commerce will set up a new airway traffic control office in the space thus vacated in the administration building The Bureau's unit will be under the direction of Earl Ward.

• FLORIDA—A traffic control tower has been completed at Jacksonville Municipal Airport. The labor for its building was supplied by the WPA.

• GEORGIA—The Raymond Aircraft Co, Miller Field, MACON, has purchased a new Aeronca. . . . Henry G Strachan of Strachan Airways, Inc., SAVANNAH Municipal Airport, is seeking appointment as manager of the field . . . More than 50 planes were scheduled to start from ATLANTA Municipal Airport Sept. 25 on a tour of about fifteen Georgia cities and towns. The tour was to finish in Atlanta on Sept 27. It was sponsored by the National Aeronautic Association and the Atlanta Chamber of Commerce as an advertising scheme for various Georgia manufacturing concerns. Prizes of several hundred dollars were set aside for winning pilots in a series of treasure hunts at the various airports. Fuel was donated by the Gulf Refining Company, through its aviation representative, Major Ralph Lockwood

• IDAHO—The WPA will construct a $37,142 hangar and classroom at the University of Idaho, Southern Branch, POCATELLO The building will be two stories high of steel and concrete construction

• ILLINOIS—A WPA improvement project was scheduled to get under way at JOLIET Municipal Airport early in September Plans call for resurfacing four runways with cement bound macadam, installation of drainage facilities, floodlights and sixteen boundary lights. . . . Abrams Aerial Survey Company, based at JOLIET Municipal Airport, is working on a contract for the aerial mapping of LIVINGSTON, FORD, BRUNDY, IROQUOIS and VERMILION counties. . . . Bernard Suverkrup, of MOLINE, won the Illinois pilots' efficiency contest at the annual State fair Eleven pilots competed Suverkrup's score was 92½ points out of a possible 100

• INDIANA—Ignatius Dienhart, superintendent of INDIANAPOLIS Municipal Airport, was planning an air show for Sept 27, featuring the Linco Aces, led by Joe Mackey . . . St Joseph Valley Aviation Club, SOUTH BEND, has decided to offer membership privileges to women. Several applications have been recorded . . . $37,000 has been released by the WPA for the purchase of new materials for runways at Paul Baer Municipal Airport, FORT WAYNE. $23,000 had previously been allotted The new grant will provide 8,000 tons of asphalt for the paving of 65,000 sq yd of runways . . . LAPORTE City Council has approved a $10,000 bond issue for purchase of the airport which it now leases This will make the field eligible for a $30,877 WPA fund for improvements, including the building of a hangar. . . . Captain Clarence F Cornish, manager of Paul Baer Municipal Airport, FORT WAYNE, was scheduled to lead a twelve-plane caravan from Fort Wayne on the second annual good-will tour of northern Indiana cities late in August. The tour was sponsored by the Fort Wayne Aero Club Scheduled stops were at GOSHEN, ROCHESTER, and LAKE WAWASEE . . . The WPA will spend $234,000 for grading and seeding, tiling and installation of drainage basins, fence and lighting equipment, and construction of building foundations at Bendix Municipal Airport, SOUTH BEND. $667,000 was originally asked.

• IOWA—OTTUMWA is considering purchase of the 124-acre municipal airport. The price is set at about $15,000, and purchase would make the field eligible for $33,000 in WPA funds.

• KANSAS—The $122,000 WPA improvement project at WICHITA Municipal Airport was scheduled for completion by Sept. 15. By mid-August, the only incomplete portion of the project was the paving of the area connecting the hangar apron with the main taxi strip in front of the administration building . . . The WICHITA Aviation Club, of which A S Swenson is president, is planning an air tour of the State Tentative dates are Oct 1 to 4. Seven ships have been signed up for the tour.

• KENTUCKY—The $10,500 WPA project for the grading and draining of Middelsboro Airport, has been completed. The drainage system required 14,400 ft. of tile The city is now considering application for additional funds for construction of hard-surfaced runways.

• LOUISIANA—24 pilots took part in an amateur air show at Shushan Airport, NEW ORLEANS, late in August. The show was sponsored by the New Orleans Aviation Club, backed by the Hobley Maynard Air Service, Inc, and the Chapman Air Service, both of which base at Shushan Miss Laura Fenner was the winner of the women's division in the spot landing contest. Bernard Deris won in the men's division.

• MAINE—The PORTLAND City Council has authorized purchase of land in WESTBROOK for erection of a radio beacon . . . RUMFORD is considering establishment of an airport as a WPA project. . . . Work on a radio range beacon at AUGUSTA was scheduled to get under way late in August It will be located ½ mile southeast of Granite Hill, 2 miles from Augusta State Airport. In addition to the antenna mast a 21x18 ft. building will be constructed to house equipment. About 90 WPA workers are busy on an improvement project at the State Airport. . . . An 80x100 ft. hangar will be erected at LEWISTON-AUBURN Airport

• MARYLAND—Louis Helman, CUMBERLAND chairman of the National Air Progress Committee, is planning a program for Cumberland to be held Sept. 1 and Oct. 1, specified by the National Aeronautic Association as Air Progress Period. . . . The BALTIMORE Board of Award has authorized bids for the supply and placing of 3,600,000 cu yd. of fill as a foundation for runways at the Municipal Airport

• MASSACHUSETTS — John H. Shobe, head of Shobe Airline Inc., Boston Municipal Airport, has added a Jacobs Beechcraft to his fleet. During its first week in operation, the ship was flown more than 3,000 miles on charter engagements . . East Coast Airways is planning the installation of radio beacons and runway and boundary markers on the 40 acre Clark Field, WEST HANOVER . . . LOWELL is considering establishment of a new airport. The city holds a five-year lease on the present airport at SOUTH LOWELL, but it would cost $75,000 to buy that property. If the city can obtain a new site, WPA assistance will be sought for its improvement . . . The WESTFIELD City Council has vested control of Barnes Municipal Airport in the city property committee The Mayor has recommended that the Council create a special three-man commission to control the port. In the meantime, until definite action is taken, the field is operated by Charles J. O'Connor . . . Red Streak Airways, Inc., based at FITCHBURG-LEOMINSTER Airport, has just purchased a Stinson cabin ship, which will be used for charter work. Officers of the company are Daniel Simonds, Joseph Fluet and A. Andre Gelinas . . . The WPA has allocated $53,000 for improvement work at TURNERS FALLS Airport.

• MICHIGAN—Clyde Cole, manager of Bishop Airport, FLINT, has announced that an application for $80,000 from the WPA has been made for improvements at the field Plans call for a new hangar, floodlights, a fourth runway, and extension of the apron in front of the hangar All runways would be hard surfaced. . . . A new 2,500-ft runway has been finished at MUSKEGON County Airport as a $58,000 WPA project It is macadam surfaced Two other runways, 2,000 and 1,200 ft. long are under construction An additional $100,000 project is being considered to lengthen the northeast-southwest runway to 3,900 ft., the northwest-southeast runway to 3,000, north-south runway to 2,400 ft., and add a new east-west runway 3,000 ft long . . . In addition to the $15,000 allocation already granted, WPA and the State Conservation Department are planning application for some $25,000 to $30,000 for enlargement of the BALDWIN Airport. . . . Drainage tile has been laid at

Reynolds Field, the JACKSON Municipal Airport. The steel framework for an 80x100-ft. hangar has been nearly completed . . . Dedication of the INDIAN RIVER Airport was scheduled for late August . . . The State Board of Aeronautics is planning installation of a radio traffic control system at the LANSING Airport, according to announcement of Floyd E. Evans, State Director of Aeronautics . . . R. K. Branch, GRAND RAPIDS, has been appointed general chairman of the National Aviation Committee of the United States Junior Chamber of Commerce.

The WPA has approved expenditure of $13,182 on the airport at DETOUR, $2,528 for HESSEL, $1,686 for MORAN, and $1,124 for BREVORT. For the whole State $1,839,508 has been allotted, which will cover improvement work now under way at 40 airports, and work scheduled for 36 more. . . . Lindbergh Field, the KALAMAZOO Municipal Airport, has been reopened after completion of an extensive improvement project that has been going on since last November.

• MINNESOTA—ST. PAUL Aviation Club is considering the formation of a St. Paul Chapter of the National Aeronautic Association.

• MISSISSIPPI—WEST POINT is considering the establishment of an airport with WPA assistance costing approximately $25,000 to $40,000 . . . City officials of JACKSON expect to ask for $300,000 from the WPA for additional improvements at the Municipal Airport, the major item calling for paving of the runways and construction of a new hangar. Work is now nearing completion on a $30,000 WPA project at the airport, which includes a new administration building, repairs to the hangar and grading of the field. . . . TUPELO Airport will be dedicated late in October.

• MISSOURI—An ordinance providing for a vote on a $1,000,000 bond issue for the improvement of the KANSAS CITY Airport is to be presented to the City Council soon. It is expected that the contemplated improvements will include concrete runways and an adequate terminal. If the ordinance is approved by the City Council it is expected that the issue will be submitted to the voters at the general election Nov. 3 . . . Ralph W. Page, manager of LAMBERT-ST. LOUIS Airport, has announced that all seven hangars at the field are occupied, two recently vacant ones being rented for a year each by the St. Louis Flying Service and Dan Robertson. St. Louis Flying Service also occupies two other hangars at the field. It was understood that Robertson will conduct a sales and service business.

• NEBRASKA — City officials of NORTH PLATTE have secured federal approval for $85,000 improvements to the Municipal Airport by revising an improvement plan to eliminate an administration building and paving aside from runways. New hangars will be financed privately . . . Ray Richardson, CAMBRIDGE, has purchased a Monocoupe . . . The new Waco recently purchased by the State Aeronautics Commission and piloted by Commission Secretary Charles R. Doyle is being used for drought relief survey flights over the Republican River Valley . . . OMAHA City Council approved the appropriation of $20,000 as sponsors' contribution toward a $200,000 WPA improvement project for the Omaha Municipal Airport. A northeast-southwest runway and a north-south runway will be built, asphalt-surfaced and lighted . . . 5,000 spectators attended the second annual American Legion Air Show at SCOTTSBLUFF late in August. Star performer was Joe Jacobson, in a stunting exhibition.

• NEVADA—WINNEMUCCA is leveling runways and installing a wind sock at the former emergency landing field south of the city.

• NEW HAMPSHIRE—Construction work on the new runway at BARRE-MONTPELIER Airport has progressed sufficiently to allow resumption of daily service by Central Vermont Airways. . . . CONCORD Air Service sponsored an air show at Concord Airport early in Septembee.

• NEW JERSEY—A report by Theodore Epprecht, manager of Central Airport, CAMDEN, for the first seven months of 1936, showed an increase of 750 passenger planes using the field over the same period in 1935. Passenger traffic was up 3,000 for the same period. These totals include only scheduled operations. . . . An application to the WPA for $3,292,333 has been made to continue the airport improvement program at NEWARK . . . The report of Lieut. Richard Aldworth, superintendent of NEWARK Airport, for the first half of 1936 showed 105,111 passengers, 919,833 lb. of express (99.1 per cent more than the corresponding period in 1935), and 1,742,000 lb. of air mail.

• NEW YORK—A two day air meet was scheduled at Martin Airport, OLEAN, Sept. 12-13. The program included a race for Taylor Cubs from Bradford, Pa., to Olean . . . ROCHESTER is considering extensive additions to the airport lighting system. Bids have been asked for equipment. . . . The Fair Flyers Club has been organized at ITHACA Airport. The club is restricted to women. Ellen Hoffman has been elected president and Josephine Townley secretary-treasurer . . . WPA has allocated $200,000 for an improvement project at UTICA Airport. Plans call for two 3,600-ft. runways and one 2,900-ft. runway. . . . SYRACUSE Aeronautic Association was planning an air show at Syracuse Airport for Sept. 19 and 20, with Milo Burcham as star attraction. . . . The $1,800,000 improvement project at Floyd Bennett Field, BROOKLYN, is scheduled for completion early in December. Included in the improvements are two 3,500-ft. concrete runways, runway lights and construction of radio traffic control stations.

• NORTH CAROLINA—Application for an additional $150,000 has been made to the WPA for improvement work at Miller Municipal Airport, WINSTON-SALEM. Work under a previously approved $14,700 project was scheduled to be started early in September. Under that project buildings which are now situated in the center of the field would be moved to the northwest corner. . . . Randolph Airport, ASHEBORO, was scheduled to open with a formal dedication and air show late in August.

• OHIO—The Bureau of Air Commerce has granted a repair station license to the Walker Lumber Company, CANTON. The mechanic will be Homer D. Miller. . . . Moore Flying Service, operators of DAYTON Municipal Airport, VANDALIA, sponsored an air show featuring the Flying Aces early in August. . . . W. Bryan Little, cooperator of the Little-Greiner Flying Service, Inc., at SPRINGFIELD Municipal Airport started his ninth year at the field in August. . . . A committee named to appraise Transcontinental Airport, TOLEDO, has set a value of $92,500 on the property. The city is considering acquiring the field so that it will be eligible for a WPA grant for improvements.

• OKLAHOMA — Cliff Giblet has formed the Oklahoma Air Taxi Service at Wiley Post Airport, OKLAHOMA CITY. He has just purchased a new Waco cabin, to add to his Waco Taperwing, Waco open, and his Wiley Post. . . . Construction work on an airport at MCALESTER was scheduled to begin early in September as a WPA project. Plans call for a hangar and administration building.

• OREGON—PORTLAND is considering application to the WPA for an additional $1,500,000 for the new Portland airport. $1,300,000 has already been allotted. The mile-square airport will have almost 10 miles of runways.

• PENNSYLVANIA—Grading work is progressing at NEW CASTLE airport. . . . During improvement work at ALLENTOWN-BETHLEHEM airport, the revolving beacon light has been disconnected. The improvement program calls

for construction of hard-surfaced runways, extension of the boundary lights, and installation of a drainage system . . . The STATE COLLEGE Borough Council has approved an application to the WPA for $120,000 for construction of a municipal airport. . . Two hundred WPA workers, under a $425,000 project, are rebuilding READING Municipal Airport . . . William Allen, Jr., Harry Stiller, and Kenneth Wolfe have opened an airport at Tarentum. A Taylor Cub is used for passenger hopping . . . The SUNBURY Airport celebrated its eight birthday early in September. Five planes are regularly hangared there. The manager is John A. Abiuso . . . Oil City Aero Club was planning an air show for early September at the Colonel Drake Airport, TITUSVILLE.

• RHODE ISLAND—The WESTERLY Town Council has voted to spend $10,740 to acquire land for a new State airport. The land consists of 180 acres south of the Boston Post Road. The State will seek WPA cooperation for the construction of the field.

• SOUTH CAROLINA—The Ways and Means Committee of CHARLESTON City Council has approved a Council appropriation of $1,200 for an air show at the municipal airport . . . The Bureau of Air Commerce has approved a $115,000 airport improvement project for FLORENCE. So far $5,000 has been spent on lighting equipment.

• SOUTH DAKOTA—An air show was planned for early September at Renner Airport, SIOUX FALLS. Featured performers were to be the Hell Divers Flying Circus.

• TENNESSEE—Concrete runway curbs are under construction as a WPA project at NASHVILLE Municipal Airport. Bids have been asked on the asphalt which will be used for the main part of the runway. The field will be dedicated Nov. 1, when it is estimated the reconstruction work will be 90 per cent complete . . . The new NASHVILLE Municipal Airport buildings were dedicated late in August by Ruth Chatterton when the Chatterton Sportsman Pilot Derby stopped there en route to Los Angeles.

• TEXAS—Runway construction at SHERMAN Municipal Airport was scheduled to start early in September as a $35,000 WPA project. The city's share of the cost will bring total expenditure up to $48,000 . . . Runways at Love Field, DALLAS Municipal Airport, will be improved with fees paid the city for use of the field by American Airlines.

• VERMONT—WPA has allotted an additional $4,046 for improvement work at ST. JOHNSBURY airport . . . BURLINGTON aldermen have voted $2,500 toward the cost of construction of a radio range beacon at the Burlington Airport . . . The MONTPELIER City Council has authorized expenditure of an additional $4,000 from the fund set aside for joint development of an airport by Montpelier and BARRE.

• VIRGINIA—STAUNTON Municipal Airport was opened late in August under the management of H. P. Grim, Jr., who has a Stinson cabin for charter service and is planning a flying school. A WPA project will provide three runways and an all-metal hangar. . . The State has made available a fund of $2,000 for airport development at WINCHESTER . . . The FARMVILLE Town Council has appropriated $770 for construction of a metal hangar at the airport. The State Highway Department has contributed another $700.

• WASHINGTON—A $185,950 WPA airport project was scheduled to start at BELLINGHAM about the middle of September . . . The SPOKANE Municipal Airport has been leased to Ivan Johnston for $180 a year.

• WEST VIRGINIA—Fette Airport, GLENDALE, was dedicated late in August . . . WPA workers have removed about 3,000 cu. yd. of earth in grading operations at Wertz Field, CHARLESTON, according to C. H. Hetzel, airport manager. The WPA allotted $54,000 for the work at the field. Plans call for lengthening two runways, adding 1,000 ft. to one and about 500 ft. to the other . . . Bill Hunt, manager of Scott Field, WHEELING, has announced plans for construction of a new hangar . . . WPA has approved expenditure of $16,900 for work on the MARTINSBURG Municipal Airport, Shepherd Field. $20,000 has already been spent on the field.

• WISCONSIN—The WPA is planning construction of three seaplane bases in the northern part of the State. They will be at WAUSAU, WISCONSIN DELLS and CHIPPEWA FALLS.

Schools

• The BOEING SCHOOL OF AERONAUTICS, Oakland (Cal.), has made special preparations to give rigid tests to blind-flying students who wish to qualify for the Bureau of Air Commerce certificates granting them permission to fly on instruments during periods of restricted visibility on the Civil Airways. George Myers is in charge of the instrument flying course at the school.

• PARKS AIR COLLEGE, East St. Louis (Ill.), has added a Lambert Monocoach to its fleet of training planes.

• Registrations for the night classes of the ROBERTSON AVIATION SCHOOL, St. Louis (Mo.) are now being received. The school was scheduled to open about the middle of September. Airplane and airplane engine mechanics, meteorology, and navigation will be taught in the night school . . . The WPA students under the direction of JACK WRIGHT, Utica (N. Y.) have finished reconstruction of a Warner-powered Monocoupe . . . Stanley W. Smith has been named as director and chief instructor of the ELMIRA (N. Y.) aviation ground school of the New York State Department of Education. Thirty-five students have registered . . . VICTOR D. GIBSON is conducting a flying school at Commercial Airport, Tulsa (Okla.). The school is operated on the club plan, and flying instruction is in a new Aeronca . . . FRED LARSON, Jamestown (N. Y.) has recently purchased his third Taylor Cub, which is used for student instruction. He has a class of 40 . . . JOHN ABIUSO, manager of the Sunbury (Pa.) Airport, reports that 25 students are taking flying instruction. Ships used are a Taylor Cub, a Waco, and a Great Lakes . . . SOUTHERN AIR SERVICES, INC., has purchased the equipment of the AERONCA FLYING SCHOOL, Memphis (Tenn.). Equipment includes two new Aeroncas. CARL WOOTEN is planning to open a flying school at Chattanooga (Tenn.), using a Waco and a Taylor Cub as flying equipment . . . Titleholders have granted free use of a field on the Southwestern boulevard, Hamburg (N.Y.) as the site for an aviation school. The HAMBURG AVIATION SCHOOL, with 30 students will be moved there, under the management of Edward E. Coon. . . John Jones and Harry Michell have organized the TACOMA FLYING SERVICE INC., at Tacoma (Wash.). Assisting as instructor will be Frank Lytle. The company will use the Mueller-Harkins Airport, which will be modernized. Flying instruction will be given in Taylor Cubs . . . ED MCLEAN and SELDON HUNNS were planning a flying school at Randolph Airport, Asheboro (N.C.) . . . The GENEVA (N.Y.) Airport will be open for student instruction on Wednesdays and Saturdays hereafter, due to the increase in student activity. Thirteen students are taking instruction . . . The ROBERTSON AVIATION SCHOOL, Robertson (Mo.), has announced that it will open a night class in airplane and engine mechanics. The class will be under the direction of J. W. Geppert, who will be assisted by Joseph A. Wright . . . The NEW ENGLAND AIRCRAFT SCHOOL, Boston (Mass.), was scheduled to open Sept. 8. The school has been established since 1928. It operates at Boston Municipal Airport . . . WESLEY H. MARDEN has organized a company to give flying instruction at Augusta (Me.) State Airport. Flying equipment will be a Stinson, a Moth and an Eaglet.

Aviation People

Who's who and what they are doing

• October, traditional moving month, finds new tenants in the traffic offices of several of the airlines United Air Lines has promoted R. F. AHRENS to district traffic manager at Chicago, after having served in the same capacity for six years at Seattle C. J MIDDLETON takes his place at Seattle, having formerly been stationed at Spokane. . . Reopening its Rochester office American Airlines has placed W. R. STEVENS in charge as city manager Heretofore he had been at Cleveland and New York . . . Northwest Airlines transferred L. M KUHNLEY from Seattle, where he was station manager, to Spokane as divisional dispatcher . . . With the extension of its Kansas City to Tulsa service, Hanford Airlines made KATHERINE MALCOLM district traffic manager Miss Malcolm was formerly with the traffic departments of Braniff and American airlines

• On Aug 17 a plane, piloted by JOE CROSSON, flew from Fairbanks, Alaska, to Pt Barrow, bearing among its five passengers Mrs Wiley Post. Silently the group disembarked, and planted on the bank of the Tundra River two iron crosses in memory of two airmen who there lost their lives,—WILL ROGERS and WILEY POST

• The transportation department of Postal Telegraph Cable Company, which handles the sale of air transportation in New York City, is now in charge of PHILIP B HIMERFELD He succeeds GUY PASCHAL, who has turned to the manufacture of an air-conditioning device which he invented

• IGOR I. SIKORSKY will fly as a passenger and observer on one of his two 15-passenger S-43 planes to be flown to Magallans, South America, for service in National Airlines of Chile Officials of the air line are at present at the Sikorsky plant, studying the planes before their departure in October

• Resignation of PHOEBE FAIRGRAVE OMLIE removes the only woman member of the N A C A Mrs Omlie, who has held the post of Special Assistant for Air Intelligence, with additional duties as liaison officer between the Committee and the Bureau of Air Commerce, plans an air tour of fourteen states, covering some 10,000 miles, in behalf of the candidacy of President Roosevelt. Eventually she expects to return to commercial aviation

Mrs. Phoebe F Omlie

Dr Joseph S Ames

Otto J. Merkel

• Three of the recipients of degrees bestowed by Norwich University at Northfield, Vt., earned them by reason of their services in the field of aeronautics. They were MAJOR ALBERT W. STEVENS, Doctor of Science, for his expedition into the stratosphere, WILLIAM P. MACCRACKEN, Doctor of Laws, for development of government guidance "of our newest means of transportation", and DR JOSEPH S AMES, Doctor of Laws, for his distinguished services in the field of aeronautical research PORTER ADAMS president of Norwich, is a former president of the NAA

• Transatlantic flyer BERYL MARKHAM was the guest of honor at a luncheon given by the Advertising Club of New York on Sept. 10, at which civic and aeronautic leaders praised her achievement. Earlier she had been officially received by MAYOR LAGUARDIA of New York.

• Three hundred guests assembled at a dinner at the Deauville Beach Club in Santa Monica on Aug. 27, to pay tribute to DONALD W. DOUGLAS, Collier trophy winner (*Aviation*, July, 1936) and president of Douglas Aircraft Company In acknowledgment Mr Douglas thanked all "in behalf of the organization that has made the Douglas airplane possible"

• The Army Base at San Bernardino, Cal, dedicated a memorial to LIEUT. PEYTON C MARCH, who was killed in Texas when in training for overseas service, and in whose honor March Field was named. BRIG GEN HENRY H ARNOLD, Assistant Chief of the Army Air Corps was among the speakers.

• Transatlantic comings and goings Arrivals HENRY A SEYFFARDT of Technisch Handelmij Hollinda N.V., Amsterdam, and HENRI HEGENER, editor of Het Vliegveld of Amsterdam both for a look-see at the industry . . . MISS PEGGY SALAMAN, British flyer, and former holder of the London-Cape Town record, to compete in the Ruth Chatterton Trophy Race. . . DR HEINRICH KOPPENBERG, General Director of Junkers Flugzeug & Motorenwerke of Germany, to attend the Third World Power Conference in Washington as well as see something of the industry . . . DR. HAGEMANN, formerly head of Junkers Corporation of America, enroute to China as representative of Junkers of Dessau Departures HENRY BERLINER, once a partner with TEMPLE JOYCE in the Berliner-Joyce Aircraft Corporation, which was purchased by North American Aviation in 1930, sailed on Sept 10 for a two-months' trip to England France and Germany Object to promote the sale of metal working instruments abroad for the Engineering & Research Corporation of Washington

CAPT FRANK T COURTNEY, whose article "Land Launched Seaplanes" appeared in September, left for England where his address is c/o The Royal Aero Club, London . . . The 'Hindenburg' bore OTTO J MERKEL of the Weser Aircraft Company of Berlin and Bremen who, after a tour of the nation's leading aviation centers, expressed keen appreciation of American design and operation of air transport . . CAPT ROY MAKEPEACE, manager of the Rand Airport, Johannesborg, who has delved deeply into the subject of American airports during his visit, returned to his native South Africa . . . MISS LUCILLE BOUCHÉ, daughter of Henri Bouche Editor of L'Aéronautique and co editor with Charles Dolfuss of L'Histoire L'Aéronautique, who found time to greet some of her father's friends

in this country before her return to France, after vacationing in the United States

• MAJOR EDGAR N. GOTT, assistant to President REUBEN H. FLEET of Consolidated Aircraft of San Diego, has been made the company's Director of Business Relations. Prior to coming with Consolidated, Major Gott was with Keystone Aircraft of Bristol, Pa., and back in 1916 was one of the members of Pacific Air Products Co., later the Boeing Airplane Co.

• BENJAMIN F. RAFFNER formerly in charge of aero-dynamic research in the Daniel Guggenheim laboratories at New York University, has been appointed assistant professor of aeronautical engineering at Oregon State College. He received his training at New York University, has had experience in teaching research and consultation, and is the author of many technical articles.

• As part of the expansion program now under way at the Longueuil factory of Fairchild Aircraft, Ltd., N. F. VANDERLIPP, aeronautical engineer, has been appointed manager of engineering and manufacturing activities. Mr. Vanderlipp's twenty years of aeronautical background dates from 1916 when he joined the design department of Standard Aircraft Corporation. In 1920 he became associated with Martin Rockwell in the development of a light airplane, then with Aeromarine on the first all metal flying boat. Later he joined the design staff of Wright Air Motors and worked on airplane and engine design for the U. S. Navy, also acted as production engineer on the "Columbia." He was production engineer on the Fokker Universal and Super Universal planes and in 1930 became chief engineer at Bellanca Aircraft Corporation, resigning to accept his present post. Announcement of Mr. Vanderlipp's appointment comes from HUBERT M. PASMORE, president.

• FRANK LUKE, JR., spectacular world-war ace, credited with the destruction of eighteen enemy aircraft before his death in action on Sept. 28, 1918, was a native son of Phoenix, Arizona. In his honor the American Legion of Arizona has established the Frank Luke, Jr., Memorial Trophy, awarded annually for the highest aggregate score in annual gunnery record firing. On Sept. 3, the 1936 trophy was presented to the 79th Pursuit Squadron, G.H.Q. Air Force, at Phoenix.

• Pan American-Grace Airways pilots JOHN P. MILLER, JOHN P. SQUIRE and WILLIAM C. BROWN have received the Medal of Valor from the government of Ecuador for participation in the rescue of two Ecuadorean army pilots, forced down in the jungle in March, 1936.

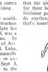
Side Slips

By Robert R. Osborn

WITH Mrs. Thaden and Miss Noyes winning first prize in the Bendix Trophy Race, Miss Ingalls second, and Miss Earhart and Miss Richey fifth, it is interesting to recall that only a few years ago the National Air Races officials were determined to exclude women pilots altogether from racing. While they then stated that their only anxiety was for the safety of the lady pilots possibly the officials were foreseeing the day when the gentler sex would be capturing most of the prize money.

These consistently good performances by the girls makes even more amusing the recollection of the first race exclusively for women at the National Air Races. The contestants started off in all directions, one pilot flying a course of her own around some windmills and another contenting herself with wide circles around the field. It was suspected in the press box that the judges had selected the winners of that race either by flipping coins or by personal preference.

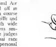
CORNELIA OTIS SKINNER, in her very clever article, "Ground Minded" in the June 6 issue of *The New Yorker*, says: "The man behind me yawns and pretends to nod. The woman across the aisle puts on her glasses and reads a copy of *The New Republic*. Fakers! The co-pilot comes back and asks each passenger if everything is all right, which is, after all, something *he* should know about. He is so beautiful, however, that he might ask you anything and it would be O.K. (I am convinced that the airlines choose their co-pilots for their beauty in order to encourage feminine patronage.) Even if we can't do anything more than die together that's something, and my sense of fear



is suddenly diluted by an infusion of the gentler passion."

It seems there must be some accuracy in Miss Skinner's listing of the necessary qualifications for an airline pilot, as the New York *Herald Tribune* states that L. V. Browne, TWA pilot, has been given a seven year contract by a Hollywood producer. The contract was drawn up after the producer had made two trips with Mr. Browne as pilot. It will be very interesting to follw the career of at least one movie actor who had to be a "he man" to hold his previous job.

"LITTLESTONE ON-SEA, England, Sept. 5th (AP) — The Reverend Cecil Boulton, M.A., curate in the parish of Emsworth, Hampshire, is a 'sky-pilot' in truth. He drops his plane on the beach here each Sunday, changes his leather coat and helmet for cassock, surplice and stole, and holds services, with the cockpit of his plane as his



pulpit and the holiday crowd of bathers as his congregation. 'The plane should be an instrument of peace, not of war,' the minister says."—*Clipping from N. Y. Herald Tribune*

This type of evangelistic work is probably reasonably successful now that airplane engines have been so much improved, but a few years ago the reverend pilot would have lost all of his converts if they had listened to him try to start the engine again.

THE PHILADELPHIA *Bulletin* has an article listing some of the suggestions received by the Weather Bureau for causing rain and ending the drought in the affected areas in this country,—"Several people have urged that a fleet of balloons or airplanes carry water from the Great Lakes and drop it on the interior.—There have been a variety of suggestions for mixing the warm air near the ground with the cooler air high above the earth. Some advocated long tunnels attached to a balloon or airplane. Others suggested the airplanes fly up and down and around to 'mix up' the air."

We can assure the government that the industry would be glad to cooperate with this program,—for a financial consideration which would help relieve the drought in the commercial airplane market also. We know a couple of manufacturers who have designs which are excellent spinners, which would be ideal for mixing up the air.

Buying of New Equipment Nears Record Figures in Transportation Field

$360,000,000 INVOLVED IN FIVE YEAR TRANSIT IMPROVEMENT PLAN

John A. Miller
Editor
Transit Journal

Engaged in the most spectacular modernization program of its entire history, the transit industry is now purchasing equipment at a rate far ahead of last year, when a 25-year record of over 4800 new passenger cars was established.

After five years of research and experiment, the new trolley car developed by the Electric Railway Presidents' Conference Committee is ready. Several big city companies are specifically interested. Orders for upwards of 400 of these cars are expected by the end of the year.

The popularity of the electric trolley bus has been increasing. More new ones have been ordered even in the first half of the present year than in any previous twelve months. Gasoline motor bus orders placed by the local transit companies are also headed for an all time peak. Companies in New York, Brooklyn, Philadelphia and San Francisco are adding hundreds of new cars on rapid transit lines.

This great modernization movement is expected to continue. Over 25,000 of the 44,000 electric cars and over 11,000 of the 18,000 buses in use today will be obsolete before the end of 1941.

Replacement vehicles will cost on an average of $10,000 each. To modernize its equipment, therefore the industry must spend a total of $360,000,000 in the next five years.

Gratifying increases in passenger traffic and revenues which have continued without interruption for over a year, have strengthened and encouraged the transit industry, to plan ahead with confidence in the future.

Purchases of operating and maintenance equipment, accessories and supplies are keeping pace with the increasing activity of the local transit companies. Other industries therefore participate in the improved conditions. Orders for steel and other metals, wire, electrical equipment, fuel, lubricants, paint and varnish, cement and scores of other special and staple commodities are moving at an increasing rate onto the books of manufacturers who are sales-minded enough to see the opportunities—*and to go after them with products and sales stories keyed to today's conditions in the transit industry.*

BUS OPERATORS BUYING EQUIPMENT AT RECORD RATE THIS YEAR

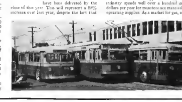
Carl W. Stocks
Editor
Bus Transportation

So far this year, it is estimated that the bus industry has bought nearly $45,000,000 worth of new vehicles, with a more than even chance of doing at least as well in the remainder of the year. At the present rate it is probable that almost 20,000 buses will have been delivered by the close of this year. This will represent a 28% increase over last year, despite the fact that bus purchases hit an all time record in 1935.

The largest delivery of vehicles to a single operating company in the first six months of 1936 was the 348 units which went to the New York City Omnibus Corporation. An order for 350 buses to Greyhound is now being filled, and the first of these new style streamlined rear-engined vehicles are just going into service throughout the country. *Everywhere the industry is buying.* Many orders are for lots of 25 to 50 buses. The business is exceedingly well distributed with the smaller producers as well as the major manufacturers working to capacity. In fact, orders are now being accepted on the basis of 90-day delivery.

New terminal projects and garages, as well as the enlargement and modernization of existing facilities, mean jobs for local contractors and orders for materials of construction.

Current statistics of the industry show that operators are running each existing bus, more miles per month, and this together with the establishment of new bus lines in many localities, means a constantly growing market for gasoline, lubricating oil and other automotive maintenance supplies. Indeed, the bus industry spends well over a hundred million dollars per year for maintenance materials and operating supplies. As a market for gas, oil and tires, each new bus added to existing fleets is equivalent to more than twenty private automobiles.



AIR TRANSPORT ENJOYING SOUND BUSINESS EXPANSION

S. P. Johnston
Editor
Aviation

This year a million people will fly on the airlines! This is up 33% over last year and more than double the traffic of 1934.

Every day passenger traffic, mail and express cargoes are mounting to new highs. Air express has doubled in volume over last year. Commercial aviation is earning its rightful place in national and international transportation. Speed, comfort and safety are now taken for granted. *Equipment is being modernized on all air lines, and construction is now under way on larger and faster machines which are expected to replace present ships by early 1938.*

Military manufacture is at an unprecedented peak, with appropriations for new planes and engines totaling about $60,000,000—nearly quadrupled over the low point of 1934. Interest is reviving in private and industrial ownership of aircraft. One manufacturer of a light airplane selling at about $1500 has recently placed an order for 1500 engines, the largest single non-military order ever placed. In 1935 the estimated purchasing power of the aviation industry was $107,000,000. The probable figure for 1936 is over $180,000,000. Manufacturers of materials, supplies and accessories are now working at top speed to keep up with rising demands.

Better business for the aviation industry carries with it better times for other industries as well. The basic raw materials, aluminum, steel, rubber and wood are being used in greater quantities. New airports call for greater consumption of cement and other paving materials and will also absorb increasing quantities of electrical equipment, lights, wiring, control units, etc. The petroleum industries benefit from increased use of gasoline and oil. Even such heavy equipment as tractors is finding an active market in this industry, not merely for use on construction, but for daily work about the airport, towing planes, removing snow, and miscellaneous maintenance jobs.

Employment figures in aircraft manufacturing and airline operations are mounting. The schools are being hard pushed to supply trained men to meet current demands. The aviation industry is well out in front in contributing to the recovery of American business.

Every day, passenger traffic, mail and express cargoes are mounting to new highs

★ ★ ★

With vehicles of new and improved design, offering advanced standards of speed and comfort, profitable passenger traffic is being won back to the electric railway lines. Meanwhile buses and air transport lines are creating new business where none existed before. Factories are humming with orders for transportation equipment. Employment is being found for many men as bus lines and air lines are extended. These are markets worth cultivating! New sales opportunities are arising every day in these transportation fields. Advertising, in properly selected business publications will help you to seek out and educate prospects. Advertising will help you to make sales contacts with these prospects, regularly and at an average cost of about one cent per contact.

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Classified Advertising

10 CENTS A WORD — $2.00 MINIMUM

Planes, Engines & Parts For Sale

Indexed—See page 74

AVRO AVIAN. Sport, Cirrus motor. Front Cockpit cover. Semi-Air-Wheels. Just relicensed. General condition excellent, $75.00. Chuck O Connor, Municipal Airport, Westfield, Mass. No. 1

WHILE THEY LAST. Pioneer Oil Temperature gauges guaranteed satisfactory $3.15, Scintilla Magnetos, five and seven cylinder, any type serviceable, $7.00, NAS 5 A Carburetor $5.00, Velie M-5 cylinder and head, $0.75. Get your order in early. Snyder Aircraft Company, Municipal Airport, Chicago. No. 2

STINSON "U" TRIMOTOR—only one in country with "J-6-7 E" motors. Special job, latest model, soundproofed bargain $4,750. Alfred Walker, 600 Graphic Arts Bldg. Kansas City, Missouri. No. 3

RANGER FAIRCHILD "24" Good as new Flown only 174 hours. Blue fuselage with yellow wings and trim. Equipped with Radio. Landing lights, and radio shielding. Priced $4,000 at du Pont Airport, Wilmington Del. No. 4

HUNDREDS OF AIRPLANES motors, crackups. Terms, trades. Complete Directory with owner's price, name and address, rushed for 25c, postpaid. Aircraft Directory, Athens, Ohio. No. 6

WARNER WACO F—Driggs, Rover powered 1935 Aeronca, Stinson S, Stinson SM 2-AB J-6-5 Aristocrat, 8x8 Travelair. Air Activities Airport, West Chicago, Ill. No. 5

4-PLACE BIRD. 1932 B 5, steel propeller, air starter, cowling for front cockpit, brakes, 8.50 x 10 tires, priced $1,500. Muncie Aviation Corp., Muncie, Indiana. No. 7

VELIE M-5 Motor. Overhauled, new rings, new valves, new guides, complete with hub $125. Want LeBlond. Kidd, Box 185, San Antonio, Texas. No. 8

J-5 RYON, overhauled, splendid condition; Waco 9 overhauled fabric refinished. Both licensed, cheap for cash. Meriwether Aircraft Corp., Manchester, Ga. No. 9

1933 WACO CABIN with Continental engine which has just been overhauled and completely modernized by factory. Extra equipment. Landing lights, flares, bank and turn, wheel pants, and steel propeller. Hand-rubbed finish in excellent condition. $3,300 at du Pont Airport, Wilmington Del. No. 10

CHALLENGER ROBIN—all blind flying instruments. Flares. Motor just Majored. Landing lights. New Tires and Tubes. Covering good. Privately owned. $985. Box 674, Shreveport, La. No. 11

EAGLEROCK HISSO. Relicensed. Excellent condition. Can be licensed with J-5, J-6-5, Challenger or Comet. $475.00. Also Waco Cabin Stephens, American Moth, Kreuer, Bird, Fairchild 51, Challenger Robin. Others. Chuck O Connor, Municipal Airport, Westfield, Mass. No. 12

D-H GIPSY MOTH, licensed, perfect, will trade on Cub. Rearwin, Continental A-40-3 motor 180 hr. Two upper wings for 2000 Travelair, $25 each. Flapper, stabilizer, streamlined wires. Irvin white silk chute $150. Wheels and tires to fit Cub. New. Brackenbrough, Lumberton, N. C. No. 13

ENGINES AND PARTS for sale. Liberty 400 hp. Hispano 180 hp, also quantities of Pratt & Whitney, Wright, Curtiss and Packard engines. The Vimalert Company, Ltd., 661 Garfield Ave., Jersey City, N. J. No. 14

NEW AIRPLANES $25.00 down, easy payments. 7.00x4 Air Wheels with hubs, $19.00 per set. Propellers $3.00 up. Send 25c for information. Hibbs, Fort Worth, Texas. No. 15

WRIGHT CYCLONE F-2 with dynamic balanced crankshaft, overhaul since complete, starter, generator, vacuum pump, and fuel pump, complete. Engine now disassembled. Will sell as is or assembled and run-in on test stand ready for flight. Also Hamilton Controllable Propeller Hub for this engine, PS-331 Aviation, 350 West 42d St., New York City. No. 16

BELLANCA SKYROCKET. In A-1 condition. Equipped with wheel pants and radio. A good buy. Western Light & Telephone Company, Huron Bldg., Kansas City, Kansas. No. 17

BROTHER CAN YOU spare a dime? If you can, send it to me and I'll send you my 1936 Low Priced Aviation Material Catalog. (Canada 20c.) Karl Ort, 693 West Poplar, York, Penna. No. 18

STEARMAN C3R—J-5 Wright Whirlwind 225 hrs. since last major. Air wheels, tail wheel, electric starter, generator and radio. Instruments in both cockpits. Ship in first class condition. Licensed to May, 1937. $1,600. Westchester Air Service, Armonk, New York. No. 19

SOLMSON EAGLET, condition like new. Pioneer instruments. 20 hours since complete reconditioning, will also sell established business cheap. Frank J. Kenyon, Hangar 2, Roosevelt Field, Mineola. No. 20

CURTISS WRIGHT Air Sedan. Powered with J-6-7 E. Completely overhauled from propeller to tail wheel. Greater Electric retractable lights, direct electric starter, generator. Wiley flares, radio, price $2,750. Sikorsky S-39, Excellent condition. Greater Electric retractable lights, parachute flares, radio, price $8,500. Curtiss Challenger Fledglings. Solair, Inc. Hangar B, Roosevelt Field, Mineola, New York. No. 21

CHALLENGER ROBIN SEAPLANE-LANDPLANE reconditioned Ed 3500 floats, new struts, rudder, seat. Motor 80 hours since major, battery, lights, starter. Landing gear in A-1 shape. A Deluxe airplane, no reasonable offer refused. J. A. Walsh, Jr. 250 Park Ave. New York City. No. 22

O X-5 American Eagle, new, license, fine shape. For Sale or Trade for late car. M. Messini, 418 So. Main St., Old Forge, Pa. No. 23

CHALLENGER ROBIN one hundred eighty hours since complete plane rebuilt including new fuselage. Motor thirty hours since top. Make offer. P.S.-332 Aviation, 330 W. 42d St., New York City. No. 24

FOR SALE OR TRADE. New Taylor Cub. Warner Waco F. J-5 Robin, OX Robin, J-5 Waco, OX Waco, Great Lakes, Lambert Monocoupe, Jacobs Waco C, J-5 Travelair, 25 Travelair. Jack's Aero Brokerage, South Omaha, Nebraska. No. 25

CAR ACCEPTED ON CHALLENGER ROBIN. Motor 40 hours. New safety glass, upholstering and tires. Hamilton steel propeller. Airspeed, tail wheel, Brakes, Dual, Starter. Licensed $1075. Roy D. Home, Arkansas City, Kansas. No. 26

BARGAIN OCTOBER ONLY. J-5 latest type Rocker Box Covers brand new 30 cents each. J-5 J-6-9 and all models wings new majored, expert certificates. Parts in above engines new and used, lowest prices. Write for lists. Lockheed Air Express, with or with out wasp, cheap. Plane just covered excellent condition. Eastern Airplane Supply Co., 303 West 54th Street, New York, N. Y. No. 26A

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CLASSIFIED ADVERTISEMENTS
CONTINUED ON PAGE 74

Classified Advertising Continued from Page 73

WINGS FOR ALL MAKES of aeroplanes, for sale. Try our wing exchange trade your wrecked wings for licensed rebuilt wings. We have been in the wing building business since 1910. N. L. Aircraft Co., Vermilion, Ohio. No. 28

PITCAIRN AUTOGIRO, 3 place with Wright E 330 hp. J6-9 motor, 500 hrs. total time. No time since complete overhaul on motor. For quick sale $1500. Motor offered separately, make offer. Newman Bros., Airport Pine Brook N. J. No. 29

EAGLET SZEKELY 45—licensed $400.00, Arrow Sport LeBlond 65 $600.00, LeBlond 7D60 Motor 15 hrs. Siems Major $200.00, LeBlond Parts, Pair 27 in. Streamline Tires $20.00, Pair J5 Scintilla Mags $25.00. Kets Aero Shop Farmland Ind. No. 38

STINSON U and T TRIMOTOR PARTS; Pilgrim parts; J6 and Wasp parts, propellers, magnetos, carburetors, starters, miscellaneous parts. General Airmotive Corp. Municipal Airport, Cleveland, Ohio. No. 31

J-5 TRAVELAIR—ship and motor just majored and rebuilt. No time since major. Bargain at $1250.00. OX Waco 10 ship just rebuilt. For quick sale $500.00. American Eagle touroplane rearked up $400.00 as is with Continental 165 good shape—10 hours since major. Skyways Inc., Cleveland Airport. No. 32

TRAVELAIR PARTS wings J-5 parts, 2 Stinson SMB-1 panels new. Stinson T wheels. Stinson and Stearman tail groups. Scintilla magneto parts. Ford wheels. Prompt and efficient service by experts on rebuilds, overhauls, refinishing and repairs at our Approved Service Station 82. Let us quote you a figure you can't beat for quality and workmanship. Skyways Inc., Cleveland Airport. No. 33

ARROW SPORT 60 LeBlond new in February 1935. 25 hrs. total time always hangared never cracked, licensed until May 1937. J. M. Brown, 203 W. Valley Ave. Shenandoah Iowa. No. 34

LINCOLN PAIGE OX-5 3—Place open Biplane licensed until August 1937. Millerized new prop. always hangared never cracked. Plane and engine excellent condition only 200 hrs. total time. Buying closed ship. Real bargain at $385.00. Wire or write B. F. Hennary, 3283 Colerain, Cincinnati Ohio. No. 35

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Buhl Pup Fuselage or complete Buhl Pup Wanted. If very reasonably priced. Amsterdam Flying Service, 283 Guy Park Avenue, Amsterdam N. Y.

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GRADUATE AERONAUTICAL ENGINEER. Advanced kinematics and drafting. Experience first consideration. Salary secondary. Best of references. Go anywhere. PW-358 Aviation, 330 West 42nd St. New York City.

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OCTOBER, 1936 ISSUE

A "bible" of practical aerodynamics

covering airplane performance and the factors that control it

Just published

Airplane Design

Volume I

PERFORMANCE

by Edward P. Warner

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Here is the first volume of a thoroughly revised and enlarged two-volume edition of the author's earlier work *Aerodynamics*. This book, complete in itself, covers those phenomena existing under steady conditions corresponding to steady flight of an airplane. In this field, the book presents the basic aerodynamic laws, phenomena and collected data and the effect they have upon airplane performance. The treatment is noteworthy for emphasis upon practical applications of aerodynamics, presenting data and methods that are invaluable to airplane designers.

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CLASSIFIED ADVERTISING

Searchlight Section

Left—The Indianapolis Airport. These 6-year-old concrete runways are now being extended with WPA funds.

Below—Floyd Bennett Airport at Brooklyn, New York, uses concrete runways and aprons. To the 156,000 sq. yds. of pavement which has served since 1929 an additional 125,000 sq. yds. has been built with WPA funds.

Modern Airports need Concrete Runways

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LONG LIFE—concrete stands up under heavy traffic, bridges weakness of the sub-grade; is unaffected by adverse weather conditions.

ACCURATE DESIGN—concrete can be designed economically for any given wheel loads with ample safety factors.

GOOD DRAINAGE—without excessive crown that makes landings hazardous, concrete's smoothness and permanently set gradients eliminate pockets of standing water.

LOW ANNUAL COST—concrete is moderate in first cost and requires the absolute minimum of maintenance throughout its long life.

Take advantage of the proved economy and satisfaction of concrete and insure a position of leadership for your airport. We can help with free information sheets and the booklet, *"Concrete Makes a Modern Airport."*

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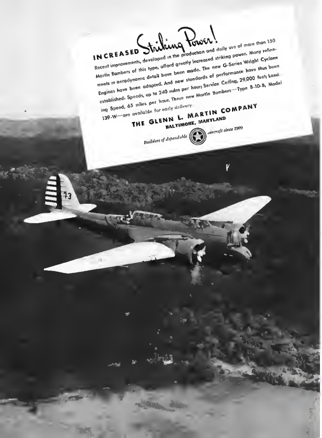
Dept. A10-41, 33 West Grand Ave., Chicago, Ill.



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Recent improvements, developed in the production and daily use of more than 150 Martin Bombers of this type, afford greatly increased striking power. Many refinements in aerodynamic detail have been made. The new G-Series Wright Cyclone Engines have been adapted. And new standards of performance have thus been established: Speeds, up to 240 miles per hour; Service Ceiling, 29,000 feet; Landing Speed, 65 miles per hour. These new Martin Bombers—Type B-10-B, Model 139-W—are available for early delivery
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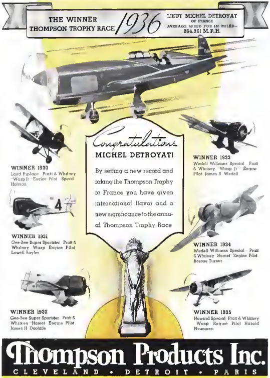

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Wedell Williams Special Pratt & Whitney Hornet Engine Pilot Roscoe Turner
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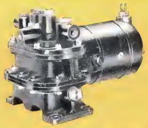
Thompson Products Inc.
CLEVELAND • DETROIT • PARIS

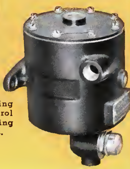


Above: Eclipse Propeller "Anti-Icer"—Pump (variable output) for application of ice removing fluids to propeller hub slinger and windshields.

Right: Eclipse Remote Control Rheostat (shielded) for propeller "Anti-Icer" pump.

Above: Eclipse Electric Motor Driven De-Icer Distributing Valve (with integral control valve) for operation wing and tail surface Goodrich De-Icers.

Left: Eclipse Electric Motor Driven De-Icer Distributing Valve (less integral control valve) for operation wing and tail surface Goodrich De-Icers.



Right: Eclipse De-Icer Oil Separator with integral regulating valve to control pressure to wing and tail De-Icers.

For Ice Elimination

ECLIPSE

Mechanical Equipment

ICE formation on aircraft wing and control surfaces, propeller hubs and windshields during winter and high altitude flying leads to obvious dangers. To eliminate ice formation, Eclipse Aviation Corporation, cooperating closely with the B. F. Goodrich Co. of Akron, Ohio (manufacturers of rubber wing and control surface De-Icers) has produced a complete line of mechanical De-Icer and Anti-Icer equipment. With them, ice can be conquered!

In addition to the units illustrated, there are available the following: Dual Motor Distributing Valves • Oil Separators less Relief Valves • Separate Pressure Relief Valves • Check Valves • Suction Regulating Valves • Engine Driven Pumps to provide required suction and air pressure for operation instruments and De-Icer equipment. Full information will be sent on request.

ECLIPSE AVIATION CORPORATION
EAST ORANGE, N. J.
(Subsidiary of Bendix Aviation Corporation)